PHYTOTOXICOLOGY SECTION INVESTIGATION IN THE VICINITY OF LAIDLAW ENVIRONMENTAL SERVICES LTD. (FORMERLY TRICIL LTD.), CORUNNA, IN 1989 AND 1990

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Excutive Summary

The Laidlaw Environmental Services Ltd. (formerly Tricil Ltd. and hereafter referred to as Tricil) operation at Corunna is an industrial waste disposal operation, that includes both the land filling of hazardous materials and the incineration of industrial wastes. There has been considerable public concern about the company. Personnel of the Phytoxicology Section have been involved in numerous complaints of vegetation damage reportedly caused by emissions from Tricil. To date only on one occasion has damage to vegetation been attributed to Tricil.

The surveys that have been carried out since 1977 were oriented towards determining if there was an accumulation of **inorganic** contaminants in vegetation resulting from emissions to the atmosphere by Tricil. Up to 1984, no evidence of **inorganic** contamination of vegetation by the operation had been found in any of the surveys by the Phytotoxicology Section. A pattern of slightly elevated concentrations of some metals was first observed in the 1986 survey data, and upon closer examination was also found in the 1985 data. A similar trend was found in the 1987 survey results. The 1987 survey also found levels of chloride in silver maple that exceeded the Phytotoxicology Section's Upper Limits of Normal. However, there was no pattern of excessive chloride that could be related to Tricil. It was assumed these high levels were due to the pockets of high salinity that occur naturally in Lambton county.

At the request of the Minister's office, the survey was significantly increased in 1989 and 1990 to determine if the high chloride levels were due to soil salinity or emissions from the Tricil operation. The survey was increased from 12 silver maple sampling sites to 20 silver maple / surface soil sampling sites and 39 moss bag sites for 1989 and 1990.

There was no evidence that the 17 inorganic elements for which the soil had been analyzed had significantly accumulated in surface soil within 5 km of the Tricil operation. If there are emissions of these elements from Tricil, they cannot be consistently distinguished from natural background concentrations in the soil at this time.

For 21 of the 29 inorganic parameters in silver maple foliage, there was either insufficient range between the minimum and maximum concentrations to generate a contour map or, where there was sufficient range, there was no pattern of accumulation associated with the Tricil operation. The test parameters with elevated concentrations associated with Tricil could be separated into two types. The first type were those with a pattern of higher concentrations around Tricil but the pattern was not strong. These included aluminum, barium, calcium, cadmium, and manganese. The second group had very low consistent background levels with a marginal but distinct concentration gradient associated with the Tricil location. These included chromium, lead and mercury (mercury only in 1990). Even though these elements were elevated, none exceeded their corresponding Rural ULN guidelines.

As with the 1987 survey, there were a large number of elevated chloride concentrations found in silver maple foliage in 1989 and 1990. Even with the expanded sampling network in 1989 and 1990 and the Surfer-generated contour maps, there was still no apparent relationship bewteen environmental chloride concentrations and Tricil. These elevated chloride concentrations are probably due to the localized deposits of salt (salt domes) in Lambton county.

For 23 of the 27 inorganic parameters in moss bags, there was either insufficient range between the minimum and maximum concentrations to generate a contour map or, where there was sufficient range, there was no pattern of accumulation associated with the Tricil operation. Calcium in moss bags for 1989 and 1990 was elevated in a similar manner as the calcium in silver maple foliage. There was a weak association with the Tricil operation for this element. The chromium levels in moss bags for both years corroborated the silver maple results. There was a consistent concentration gradient for chromium around Tricil. The elevated levels of aluminum, barium, lead, manganese and mercury that occurred in the silver maple foliage were not observed in the moss bags due to the significantly higher natural background level of these elements in the moss. Magnesium also had a strong but inconsistent pattern within about one kilometer of the Tricil operation in both 1989 and 1990.

It is not possible to determine if the incinerator or the land fill operation was the source of the elevated concentrations. However, the aluminum, calcium and manganese elevations could be related to dust created by the landfill operation. These are common components of the clay soil found in the area.

These surveys concluded that Tricil is not a significant source of inorganic emissions to the atmosphere, and that inorganic contamination has not accumulated in the surface soil. However, based on the analysis of soil, tree foliage, and moss bags and the computer-generated contour maps, Tricil, either through process emissions from the incinerator or fugitive emissions from the landfill, may be a marginal source of aluminum, barium, cadmium, calcium, chromium, lead, manganese, and mercury. In all cases, these concentrations were only marginally elevated above local background and did not exceed rural ULN guidelines for soil and tree foliage. Therefore, at this time, the degree of contamination was considered to be environmentally inconsequential and would not interfere with the normal use of the land.

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Section 1: Background

The Laidlaw Environmental Services Ltd. (formerly Tricil Ltd. and hereafter referred to as Tricil) operation at Corunna is an industrial waste disposal operation, that includes both the land filling of hazardous materials and the incineration of industrial wastes. There has been considerable public concern about the company. Personnel of the Phytoxicology Section have been involved in numerous complaints of vegetation damage reportedly caused by emissions from Tricil. To date only on one occasion has damage to vegetation been attributed to Tricil. This was the result of water runoff from the landfill site killing a number of trees immediately adjacent to the company (references 3-12 document historical Phytotoxicology activity around Tricil).

The surveys that have been carried out since 1977 were oriented towards determining if there was an accumulation of **inorganic** contaminants in vegetation resulting from emissions to the atmosphere by Tricil. Up to 1984, no evidence of **inorganic** contamination of vegetation by the operation had been found in any of the surveys by the Phytotoxicology Section. A pattern of slightly elevated concentrations of some metals was first observed in the 1986 survey data, and upon closer examination was also found in the 1985 data. A similar trend was found in the 1987 survey results. The 1987 survey also found levels of chloride in silver maple that exceeded the Phytotoxicology Section's Upper Limits of Normal. However, there was no pattern of excessive chloride that could be related to Tricil. It was assumed these high levels were due to the pockets of high salinity that occur naturally in Lambton county.

The Phytotoxicology Section has been conducting an annual assessment survey in the vicinity of Tricil every year since 1977, except for 1980 and 1988. The original survey consisted of 30 sampling stations within 10 km of the operation. The number of stations has changed from year to year. In the original survey, silver maple foliage and soil were collected. The 1978 survey was the last year soil was collected. Grass samples were collected the four year period (1978 to 1982). At the request of the Minister's office, the survey was significantly increased in 1989 and 1990 to determine if the high chloride levels were due to soil salinity or emissions from the Tricil operation. Appendix A summarizes the type of samples collected and the number of stations sampled in each year.

Section 2: Methods

On May 31, 1989, thirty nine moss bag stations were established in a modified grid pattern within 12 km of the Tricil operation in Corruna (see Figure 1). One 3 gram moss bag was used at each location. These moss bags were changed on June 30, July 27, and August 29,1989.

On August 22 and 23, 1989, Randall Jones of the Phytotoxicology Section, Air Resources Branch, Ministry of the Environment accompanied by two additional Ministry staff conducted a vegetation and soil survey in the vicinity of the Tricil operation. Duplicate samples of silver maple foliage and soil (0-25 cm in depth) were collected at twenty locations within 12 km of Tricil (see Figure 2). Visual inspections were made of the native vegetation at each location for symptoms of air pollution damage. The twenty sampling locations consisted of the same 13 locations sampled in 1988 plus seven other sampling locations that had not been sampled since 1981.

Figure 1. Map Showing the Appoximate Locations of the 39 Moss Bag Sites in the Vicinity of Tricil Ltd., Corruna, in 1989 and 1990.

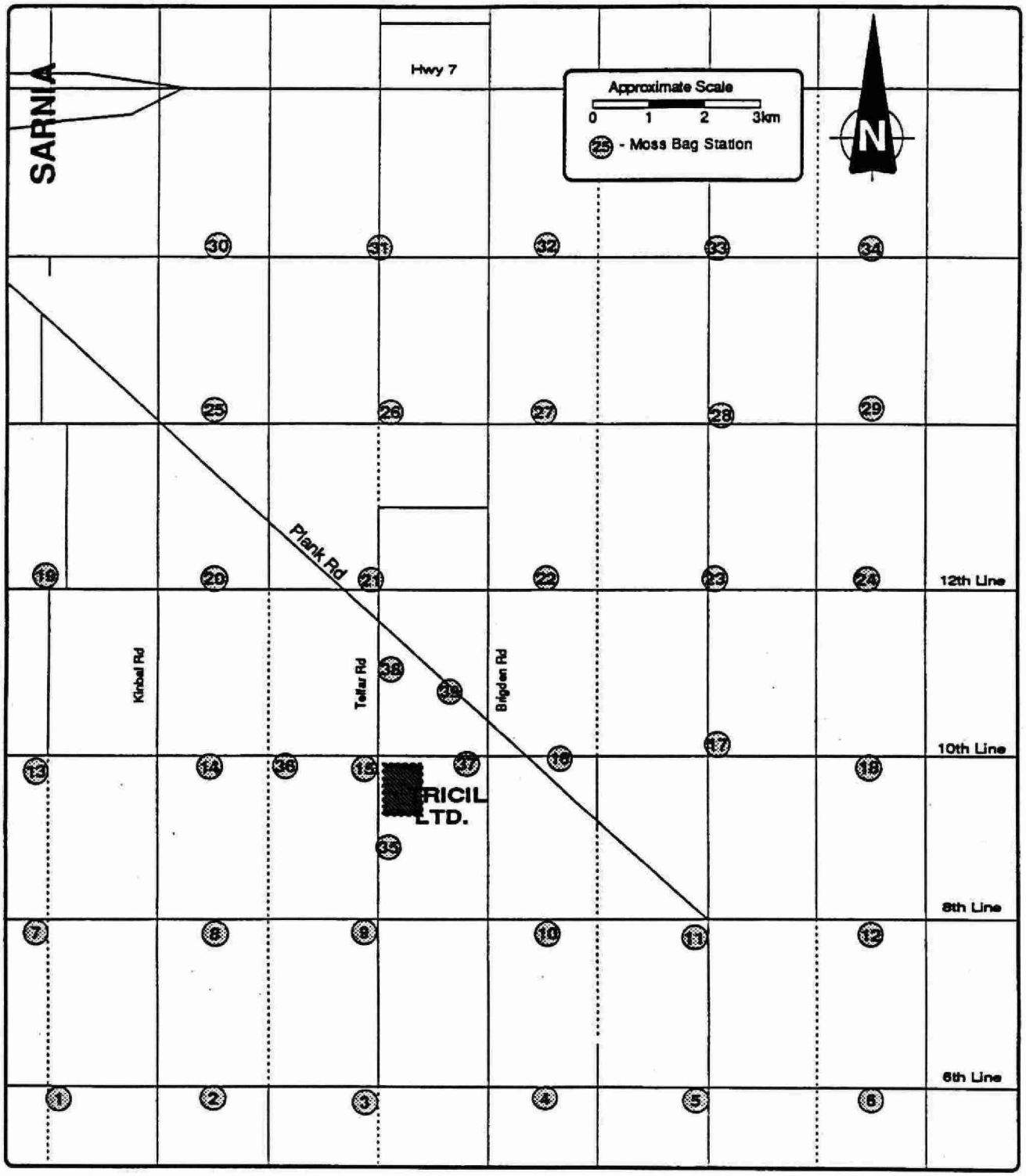
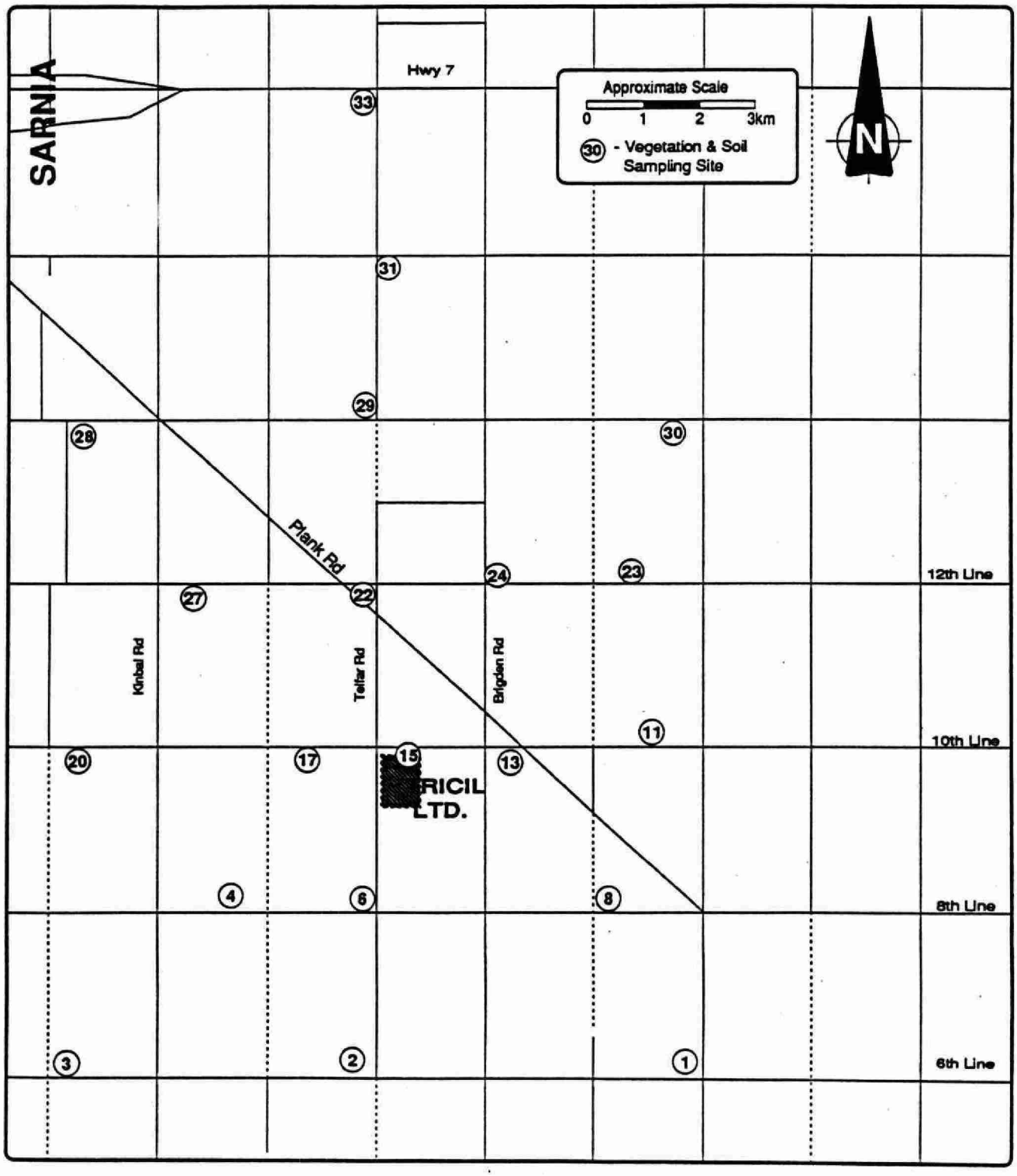


Figure 2. Map Showing the Appoximate Locations of the 20 Silver Maple and Soil Sites in the Vicinity of Tricil Ltd., Corruna, in 1989 and 1990.



On May 31, 1990, thirty nine moss bag stations were established at the same sites as in the 1989 moss bag survey. Unlike the 1989 survey, two 3 gram moss bags were used at each site and these moss bags where exposed for the three month period of June, July and August.

On August 21 and 22, 1990, Randall Jones of the Phytotoxicology Section, Air Resources Branch, Ministry of the Environment accompanied by one additional Ministry staff conducted a vegetation survey in the vicinity of the Tricil operation. The same twenty locations within 12 km of Tricil sampled in the 1989 survey were sampled for silver maple foliage in 1990. Duplicate samples were collected at each location for chemical analysis. Visual inspections were made of the native vegetation at each location for symptoms of air pollution damage.

The samples where collected using standard Phytotoxicology sampling techniques (1). All samples for analysis were delivered to the Phytotoxicology Section sample processing laboratory in Toronto where they were dried and ground before being submitted to the Inorganic Trace Contaminants Section, Laboratory Services Branch for inorganic chemical analysis. The 1990 silver maple foliage was analyzed for aluminum, antimony, arsenic, barium, beryllium, boron, cadmium, calcium, chloride, chromium, cobalt copper, fluoride, iron lead, magnesium, manganese, mercury, molybdenum, nickle, nitrogen, phosphorus, potassium, selenium, sodium, strontium, sulphur, vanadium and zinc. The 1989 silver maple foliage analysis did not include boron. The 1990 moss bag analysis did not include phosphorus, and potassium. The 1989 moss bag analysis did not include boron, nitrogen, phosphorus, and potassium. The 1989 soil analysis did not include barium, beryllium, boron, calcium, fluoride, magnesium, mercury, nitrogen phosphorus, potassium and sulphur.

Section 3: Results

The result are summarized in the following 29 tables. There is one table for each element. Each table contains the results of the soil, vegetation and mossbag surveys for 1989 and 1990. Also listed in each table is the Phytotoxicology Section Urban Upper Limit of Normal for each element, where available (2). Levels exceeding the Upper Limits of Normal (ULN) have been underlined. The data are expressed as either %, mg/g, or µg/g dry weight and are the mean of the duplicate samples, excluding moss bags, collected at each site. Results with the "less than" symbol "<" mean that the concentration is below the minimum reporting limit for the analytical method. Results followed by a capital "T" are considered tentative estimates or trace amounts.

In addition to the three individual monthly moss bag results for 1989, the average of the three months is also provided. The 1990 moss bag results are for the full three month period, and are thus not directly comparable to the 1989 monthly or average results.

There was no visible injury on any of the vegetation that was inspected in 1989 and 1990 that could be related to air pollution. All of the injury observed was due to insects, disease or physiological stress.

Table 1: Results of Chemical Analysis for Aluminum in Soil, Silver Maple Foliage and Mossbags in the Vicinity of Tricil Ltd. , Corruna in 1989 and 1990 (all results are in ug/g dry weight)

	Soil	Maple Foliage	
St. No.	1989	1989	1990
1	22000	85	81
2	18000	48	52
3	18000	59	83
4	18000	50	67
6	17000	52	68
8	9700	52	60
11	16000	120	120
13	22000	92	ND
15	14000	105	145
17	22000	74	110
20	18000	55	87
22	18000	130	63
23	16000	140	74
24	16000	110	110
27	22000	36	69
28	18000	99	74
29	2000	46	ND
30	14000	64	86
31	8400	54	80
32	11000	64	86
ULN	NG	500	500

	Moss Bags				
St. No.	Jun-89	Jul-89	Aug-89	Mean-89	Jun-Aug/90
1	790	870	1000	887	1000
2	850	870	1300	1007	1000
3	650	1300	1100	1017	820
4	960	1200	1000	1053	910
5	1200	1200	1400	1267	1100
6	820	1000	1400	1073	ND
7	840	100	130	357	1800
8	1100	950	1200	1083	1200
9	980	1200	1100	1093	1900
10	780	1100	960	947	1700
11	810	1400	1200	1137	1100
12	930	1400	1400	1243	1600
13	1200	1400	1100	1233	1000
14	950	1300	1100	1117	1200
15	910	1400	1000	1103	1700
16	1000	820	1300	1040	1600
17	ND	910	ND	910	1400
18	930	710	1100	913	1500
19	900	940	1200	1013	1200
20	1000	880	1000	960	1400
21	1000	830	1300	1043	1600
22	790	850	1100	913	1400
23	1100	980	1300	1127	2100
24	910	860	1100	957	1400
25	ND	110	910	510	1300
26	1100	990	980	1023	1500
27	850	870	1200	973	1400
28	1000	1000	1200	1067	1500
29	1200	1200	1200	1200	1500
30	930	1100	1100	1043	850
31	840	ND	1100	970	960
32	840	1100	1200	1047	1300
33	1200	760	1000	987	2000
34	930	880	1100	970	ND
35	920	ND	1300	1110	1500
36	810	9600	1300	3903	1400
37	1400	1200	1300	1300	1100
38	720	120	170	337	1500
39	1100	990	1000	1030	1800
ULN	1700	1700	1700		NG

ND - no data
NG - no ULN guideline.

Table 2: Results of Chemical Analysis for Antimony in Soil, Silver Maple Foliage and Mossbags in the Vicinity of Tricil Ltd. , Corruna in 1989 and 1990 (all results are in ug/g dry weight)

	Soil	Maple Foliage	
St. No.	1989	1989	1990
1	0.35 T	<0.2	<0.2
2	0.35 T	<0.2	<0.2
3	0.32 T	<0.2	<0.2
4	0.35 T	0.5 T	<0.2
6	0.35 T	0.5 T	<0.2
8	0.20 T	0.5 T	<0.2
11	0.27 T	<0.2	<0.2
13	0.27 T	<0.2	ND
15	0.86 T	<0.2	<0.2
17	0.44 T	<0.2	<0.2
20	0.38 T	<0.2	<0.2
22	0.35 T	<0.2	<0.2
23	0.26 T	<0.2	<0.2
24	0.20 T	<0.2	<0.2
27	0.27 T	<0.2	<0.2
28	0.35 T	<0.2	<0.2
29	0.27 T	<0.2	ND
30	0.20 T	<0.2	<0.2
31	1.30 T	<0.2	<0.2
32	0.20 T	<0.2	<0.2
ULN	1	0.3	0.3

	Moss Bags				
St. No.	Jun-89	Jul-89	Aug-89	Mean-89	Jun-Aug/90
1	0.24 T	0.94 T	0.21 T	0.46 T	0.34 T
2	0.31 T	0.37 T	<0.20	0.29 T	0.39 T
3	0.20 T	0.32 T	<0.20	0.24 T	0.80 T
4	0.25 T	0.37 T	<0.20	0.27 T	0.86 T
5	0.26 T	0.37 T	<0.20	0.28 T	0.89 T
6	0.54 T	0.33 T	<0.20	0.36 T	ND
7	<0.20	0.32 T	0.40 T	0.31 T	1.10 T
8	0.22 T	0.28 T	0.36 T	0.29 T	0.69 T
9	0.20 T	0.66 T	0.37 T	0.41 T	0.87 T
10	0.23 T	0.38 T	0.26 T	0.29 T	0.57 T
11	<0.20	0.38 T	0.26 T	0.28 T	0.47 T
12	<0.20	0.24 T	0.33 T	0.26 T	0.48 T
13	0.23 T	0.32 T	0.33 T	0.29 T	0.48 T
14	0.21 T	0.32 T	0.26 T	0.26 T	0.47 T
15	0.24 T	0.38 T	0.32 T	0.31 T	0.47 T
16	<0.20	0.24 T	0.39 T	0.28 T	0.36 T
17	ND	<0.20	ND	0.20 T	0.35 T
18	<0.20	<0.20	0.56 T	0.32 T	0.45 T
19	<0.20	<0.20	0.33 T	0.24 T	0.24 T
20	<0.20	<0.20	0.33 T	0.24 T	0.34 T
21	<0.20	<0.20	0.34 T	0.25 T	0.34 T
22	<0.20	<0.20	0.35 T	0.25 T	0.34 T
23	<0.20	<0.20	0.40 T	0.27 T	0.44 T
24	<0.20	<0.20	0.27 T	0.22 T	0.34 T
25	ND	<0.20	0.43 T	0.32 T	0.34 T
26	<0.20	<0.20	0.33 T	0.24 T	0.43 T
27	<0.20	<0.20	0.33 T	0.24 T	0.34 T
28	<0.20	<0.20	0.33 T	0.24 T	0.33 T
29	<0.20	<0.20	0.27 T	0.22 T	0.55 T
30	<0.20	<0.20	0.39 T	0.26 T	0.10 T
31	<0.20	<0.20	0.23 T	0.21 T	0.23 T
32	<0.20	<0.20	0.32 T	0.24 T	0.33 T
33	0.48 T	<0.20	0.37 T	0.35 T	0.43 T
34	1.20 T	<0.20	0.37 T	0.59 T	ND
35	0.32 T	ND	0.25 T	0.29 T	0.34 T
36	0.33 T	<0.20	0.31 T	0.28 T	0.44 T
37	0.24 T	<0.20	0.31 T	0.25 T	0.23 T
38	0.27 T	<0.20	0.25 T	0.24 T	0.44 T
39	0.28 T	0.40 T	0.35 T	0.34 T	0.23 T
ULN	NG	NG	NG		NG

ND - no data
NG - no ULN guideline.

T - all results below 2.0 ug/g are considered trace amounts
< -less than the smallest measurable amount for this analytical method

Table 3: Results of Chemical Analysis for Arsenic in Soil, Silver Maple Foliage and Mossbags in the Vicinity of Tricil Ltd. , Corruna in 1989 and 1990 (all results are in ug/g dry weight)

	Soil	Maple Foliage	
St. No.	1989	1989	1990
1	7.6	<.02	<.02
2	4.8	<.02	<.02
3	5.9	<.02	<.02
4	6.2	<.02	<.02
6	4.8	<.02	<.02
8	3.8	<.02	<.02
11	3.9	<.02	<.02
13	4.3	<.02	ND
15	5.4	<.02	<.02
17	6.6	<.02	<.02
20	6.6	<.02	<.02
22	4.8	<.02	<.02
23	5.0	<.02	<.02
24	4.2	<.02	<.02
27	4.4	<.02	<.02
28	6.0	<.02	<.02
29	3.4	<.02	ND
30	3.9	<.02	<.02
31	4.0	<.02	<.02
32	4.0	<.02	<.02
ULN	10	75	75

	Moss Bags				
St. No.	Jun-89	Jul-89	Aug-89	Mean-89	Jun-Aug/90
1	0.37 T	0.47 T	1.10 T	0.65 T	0.99 T
2	1.20 T	0.50 T	1.10 T	0.93 T	1.00 T
3	0.38 T	1.40 T	0.50 T	0.76 T	0.77 T
4	1.20 T	1.20 T	0.49 T	0.96 T	0.80 T
5	1.10 T	1.20 T	0.50 T	0.93 T	0.62 T
6	0.48 T	0.50 T	1.20 T	0.73 T	ND
7	0.33 T	0.49 T	1.30 T	0.71 T	0.95 T
8	1.20 T	0.40 T	0.50 T	0.70 T	0.58 T
9	0.41 T	0.36 T	1.20 T	0.66 T	0.84 T
10	0.49 T	1.20 T	0.41 T	0.70 T	0.63 T
11	0.34 T	1.20 T	0.48 T	0.67 T	0.63 T
12	0.46 T	0.42 T	0.50 T	0.46 T	0.75 T
13	1.30 T	1.10 T	0.49 T	0.96 T	0.76 T
14	1.50 T	1.20 T	1.10 T	1.27 T	0.78 T
15	0.36 T	0.45 T	1.20 T	0.67 T	1.30 T
16	0.43 T	0.27 T	1.40 T	0.70 T	0.84 T
17	ND	0.40 T	17.00	8.70	1.00 T
18	0.42 T	0.42 T	1.10 T	0.64 T	0.87 T
19	0.36 T	0.40 T	0.43 T	0.40 T	0.95 T
20	0.50 T	0.37 T	1.20 T	0.69 T	0.99 T
21	0.45 T	0.38 T	0.50 T	0.44 T	0.98 T
22	0.45 T	0.35 T	1.10 T	0.63 T	0.79 T
23	0.44 T	0.49 T	1.20 T	0.71 T	1.10 T
24	0.46 T	0.34 T	1.30 T	0.70 T	0.84 T
25	ND	0.30 T	1.10 T	0.70 T	0.96 T
26	0.46 T	0.46 T	1.10 T	0.67 T	0.93 T
27	0.45 T	0.42 T	1.30 T	0.72 T	0.83 T
28	1.20 T	0.50 T	1.20 T	0.97 T	1.10 T
29	0.46 T	0.45 T	0.45 T	0.45 T	0.93 T
30	0.44 T	0.38 T	1.20 T	0.67 T	0.57 T
31	0.39 T	0.38 T	1.30 T	0.69 T	0.62 T
32	0.37 T	0.42 T	0.50 T	0.43 T	0.84 T
33	0.53 T	0.40 T	1.20 T	0.71 T	0.89 T
34	0.13 T	0.37 T	0.50 T	0.33 T	ND
35	0.47 T	ND	0.49 T	0.48 T	0.80 T
36	0.39 T	4.90	1.10 T	2.13	0.79 T
37	0.39 T	0.47 T	1.60 T	0.82 T	0.73 T
38	0.42 T	0.44 T	1.40 T	0.75 T	0.73 T
39	1.30 T	0.43 T	1.20 T	0.98 T	1.20 T
ULN	1	1	1		NG

ND - no data
NG - no ULN guideline.

T - all results below 2.0 ug/g are considered trace amounts
< -less than the smallest measurable amount for this analytical method

Table 4: Results of Chemical Analysis for Barium in Silver Maple Foliage and Mossbags in the Vicinity of Tricil Ltd. , Corruna in 1989 and 1990 (all results are in ug/g dry weight)

	Soil	Maple Foliage	
St. No.	1989	1989	1990
1	NA	5.2	4.4 T
2	NA	5.6	6.0
3	NA	3.4 T	6.2
4	NA	4.2 T	5.0 T
6	NA	3.8 T	5.9
8	NA	4.0 T	7.3
11	NA	5.2	5.9
13	NA	6.8	ND
15	NA	8.7	9.3
17	NA	4.3 T	5.2
20	NA	2.9 T	4.2 T
22	NA	5.0	5.6
23	NA	5.6	6.9
24	NA	9.2	10.0
27	NA	2.6 T	3.7 T
28	NA	5.5	7.0
29	NA	5.3	ND
30	NA	4.4 T	8.2
31	NA	4.6 T	6.3
32	NA	5.2	5.4
ULN	NG	NG	NG

	Moss Bags				
St. No.	Jun-89	Jul-89	Aug-89	Mean-89	Jun-Aug/90
1	32	33	33	33	42
2	29	29	37	32	30
3	36	30	33	33	30
4	24	28	35	29	29
5	30	28	31	30	43
6	37	32	35	35	ND
7	31	34	34	33	32
8	25	36	39	33	57
9	37	43	33	38	53
10	26	30	36	31	49
11	27	29	38	31	48
12	34	31	34	33	35
13	30	34	34	33	55
14	29	35	37	34	56
15	30	45	34	36	41
16	38	38	34	37	37
17	ND	36	ND	36	37
18	31	34	37	34	39
19	29	38	34	34	33
20	29	36	33	33	37
21	34	35	38	36	36
22	31	37	36	35	37
23	39	39	39	39	40
24	30	35	35	33	37
25	ND	36	37	37	38
26	34	36	34	35	41
27	45	39	34	39	40
28	35	37	36	36	37
29	36	38	35	36	38
30	32	35	32	33	61
31	30	ND	32	31	82
32	38	40	38	39	43
33	29	38	37	35	41
34	35	36	39	37	ND
35	33	ND	30	32	43
36	33	52	34	40	45
37	31	36	35	34	36
38	28	38	31	32	36
39	32	38	31	34	21
ULN	NG	NG	NG		NG

NA - not analyzed
ND - no data
NG - no ULN guideline.

T - all results below 5.0 ug/g are considered trace amounts
< -less than the smallest measurable amount for this analytical method

Table 5: Results of Chemical Analysis for Beryllium in Silver Maple Foliage and Mossbags in the Vicinity of Tricil Ltd. , Corruna in 1989 and 1990 (all results are in ug/g dry weight)

	Soil	Maple Foliage	
St. No.	1989	1989	1990
1	NA	0.1 T	0.1 T
2	NA	0.1 T	0.1 T
3	NA	0.2 T	0.1 T
4	NA	0.1 T	0.1 T
6	NA	0.2 T	0.1 T
8	NA	0.1 T	0.1 T
11	NA	0.2 T	0.1 T
13	NA	0.3 T	ND
15	NA	0.2 T	0.1 T
17	NA	0.1 T	0.1 T
20	NA	0.2 T	0.1 T
22	NA	0.1 T	0.1 T
23	NA	0.3 T	0.1 T
24	NA	0.2 T	0.1 T
27	NA	0.1 T	0.1 T
28	NA	0.4 T	0.1 T
29	NA	0.1 T	ND
30	NA	0.2 T	0.1 T
31	NA	0.2 T	0.1 T
32	NA	0.3 T	0.1 T
ULN	NG	NG	NG

	Moss Bags				
St. No.	Jun-89	Jul-89	Aug-89	Mean-89	Jun-Aug/90
1	0.50	0.50	0.50	0.50	<0.05
2	0.50	0.50	0.30 T	0.43 T	<0.05
3	0.50	0.30 T	0.50	0.43 T	<0.05
4	0.50	0.50	0.10 T	0.37 T	<0.05
5	0.50	0.10 T	0.30 T	0.30 T	0.10 T
6	0.50	0.50	0.50	0.50	ND
7	0.10 T	0.50	0.20 T	0.27 T	0.10 T
8	0.50	0.10 T	0.60	0.40 T	0.10 T
9	0.50	0.10 T	0.50	0.37 T	0.10 T
10	0.50	0.50	0.10 T	0.37 T	<0.05
11	0.50	0.10 T	0.50	0.37 T	<0.05
12	0.50	0.60	0.10 T	0.40 T	<0.05
13	0.50	0.40 T	0.10 T	0.33 T	<0.05
14	0.50	0.50	0.50	0.50	<0.05
15	0.50	0.50	0.30 T	0.43 T	0.10 T
16	0.50	0.10 T	0.50	0.37 T	0.10 T
17	ND	0.00 T	ND	0.00 T	0.10 T
18	0.40 T	0.50	0.50	0.47 T	0.10 T
19	0.50	0.50	0.10 T	0.37 T	0.10 T
20	0.50	0.50	0.30 T	0.43 T	0.10 T
21	0.50	0.50	0.50	0.50	0.10 T
22	0.50	0.30 T	0.50	0.43 T	0.10 T
23	0.50	0.40 T	0.10 T	0.33 T	0.10 T
24	0.50	0.10 T	0.50	0.37 T	0.10 T
25	ND	0.00 T	0.10 T	0.05 T	0.10 T
26	0.50	0.15 T	0.30 T	0.32 T	0.10 T
27	0.50	0.50	0.50	0.50	0.10 T
28	0.50	0.30 T	0.10 T	0.30 T	0.10 T
29	0.30 T	0.30 T	0.30 T	0.30 T	0.10 T
30	0.50	0.50	0.50	0.50	<0.05
31	0.50	ND	0.50	0.50	<0.05
32	0.50	0.15 T	0.30 T	0.32 T	0.10 T
33	0.40 T	0.50	0.10 T	0.33 T	0.10 T
34	0.50	0.30 T	0.80	0.53	ND
35	0.10 T	ND	0.40 T	0.25 T	0.10 T
36	0.10 T	1.00	0.50	0.53	0.10 T
37	0.80	0.15 T	0.30 T	0.42 T	0.10 T
38	0.50	0.10 T	0.10 T	0.23 T	0.10 T
39	0.10 T	0.30 T	0.10 T	0.17 T	0.10 T
ULN	NG	NG	NG		NG

NA - not analyzed
ND - no data
NG - no ULN guideline.

T - all results below 0.5 ug/g are considered trace amounts
< -less than the smallest measurable amount for this analytical method

Table 6: Results of Chemical Analysis for Boron in Silver Maple Foliage and Mossbags in the Vicinity of Tricil Ltd. , Corruna in 1989 and 1990 (all results are in ug/g dry weight)

	Soil	Maple Foliage	
St. No.	1989	1989	1990
1	NA	NA	35
2	NA	NA	52
3	NA	NA	28
4	NA	NA	33
6	NA	NA	40
8	NA	NA	36
11	NA	NA	37
13	NA	NA	ND
15	NA	NA	41
17	NA	NA	40
20	NA	NA	26
22	NA	NA	48
23	NA	NA	49
24	NA	NA	48
27	NA	NA	27
28	NA	NA	32
29	NA	NA	ND
30	NA	NA	42
31	NA	NA	53
32	NA	NA	28
ULN	10	75	75

	Moss Bags				
St. No.	Jun-89	Jul-89	Aug-89	Mean-89	Jun-Aug/90
1	NA	NA	NA	NA	5 T
2	NA	NA	NA	NA	7 T
3	NA	NA	NA	NA	4 T
4	NA	NA	NA	NA	6 T
5	NA	NA	NA	NA	8 T
6	NA	NA	NA	NA	ND
7	NA	NA	NA	NA	15
8	NA	NA	NA	NA	8 T
9	NA	NA	NA	NA	11
10	NA	NA	NA	NA	8 T
11	NA	NA	NA	NA	10
12	NA	NA	NA	NA	11
13	NA	NA	NA	NA	7 T
14	NA	NA	NA	NA	9 T
15	NA	NA	NA	NA	10
16	NA	NA	NA	NA	7 T
17	NA	NA	NA	NA	6 T
18	NA	NA	NA	NA	8 T
19	NA	NA	NA	NA	7 T
20	NA	NA	NA	NA	6 T
21	NA	NA	NA	NA	5 T
22	NA	NA	NA	NA	5 T
23	NA	NA	NA	NA	9 T
24	NA	NA	NA	NA	6 T
25	NA	NA	NA	NA	6 T
26	NA	NA	NA	NA	11
27	NA	NA	NA	NA	7 T
28	NA	NA	NA	NA	9 T
29	NA	NA	NA	NA	5 T
30	NA	NA	NA	NA	5 T
31	NA	NA	NA	NA	6 T
32	NA	NA	NA	NA	7 T
33	NA	NA	NA	NA	5 T
34	NA	NA	NA	NA	ND
35	NA	NA	NA	NA	13
36	NA	NA	NA	NA	8 T
37	NA	NA	NA	NA	6 T
38	NA	NA	NA	NA	6 T
39	NA	NA	NA	NA	12
ULN	NG	NG	NG		NG

NA - not analyzed
ND - no data
NG - no ULN guideline.

T - all results below 10 ug/g are considered trace amounts
< -less than the smallest measurable amount for this analytical method

Table 7: Results of Chemical Analysis for Cadmium in Soil, Silver Maple Foliage and Mossbags in the Vicinity of Tricil Ltd. , Corruna in 1989 and 1990 (all results are in ug/g dry weight)

	Soil	Maple Foliage	
St. No.	1989	1989	1990
1	0.50	<0.10	<0.10
2	0.39 T	0.26 T	0.14 T
3	0.27 T	0.18 T	<0.10
4	0.27 T	<0.10	<0.10
6	0.46 T	<0.10	<0.10
8	0.54	0.18 T	<0.10
11	0.52	<0.10	0.18 T
13	0.48 T	0.43 T	ND
15	0.54	0.24 T	0.20 T
17	0.44 T	0.28 T	<0.10
20	0.44 T	0.42 T	<0.10
22	0.49 T	0.48 T	0.15 T
23	0.36 T	0.50 T	0.13 T
24	0.30 T	0.44 T	0.25 T
27	0.57	<0.10	0.14 T
28	0.52	0.40 T	0.23 T
29	0.60	0.42 T	ND
30	0.38 T	0.71 T	0.21 T
31	0.35 T	<0.10	0.16 T
32	0.52	0.46 T	<0.10
ULN	3	1	1

	Moss Bags				
St. No.	Jun-89	Jul-89	Aug-89	Mean-89	Jun-Aug/90
1	0.40 T	0.38 T	0.30 T	0.36 T	0.44 T
2	0.38 T	0.50 T	0.28 T	0.39 T	0.48 T
3	0.56 T	0.40 T	0.24 T	0.40 T	0.50 T
4	0.40 T	0.36 T	0.30 T	0.35 T	0.46 T
5	0.36 T	0.28 T	0.28 T	0.31 T	0.36 T
6	0.38 T	0.28 T	0.34 T	0.33 T	ND
7	0.60 T	0.30 T	0.20 T	0.37 T	0.36 T
8	0.40 T	0.28 T	0.58 T	0.42 T	0.62 T
9	0.50 T	0.36 T	0.30 T	0.39 T	0.46 T
10	0.50 T	0.30 T	0.30 T	0.37 T	0.56 T
11	0.34 T	0.30 T	0.22 T	0.29 T	0.40 T
12	0.28 T	0.68 T	0.24 T	0.40 T	0.40 T
13	0.36 T	0.24 T	0.18 T	0.26 T	0.52 T
14	0.40 T	0.18 T	0.26 T	0.28 T	0.52 T
15	0.22 T	0.30 T	0.28 T	0.27 T	0.52 T
16	0.44 T	0.20 T	0.20 T	0.28 T	0.36 T
17	ND	0.26 T	ND	0.26 T	0.34 T
18	0.54 T	0.24 T	0.28 T	0.35 T	0.42 T
19	0.34 T	0.18 T	0.36 T	0.29 T	0.38 T
20	0.26 T	0.26 T	0.36 T	0.29 T	0.40 T
21	0.48 T	0.28 T	0.34 T	0.37 T	0.36 T
22	0.42 T	0.30 T	0.36 T	0.36 T	0.48 T
23	0.50 T	0.32 T	0.32 T	0.38 T	0.34 T
24	0.46 T	0.30 T	0.32 T	0.36 T	0.40 T
25	ND	0.26 T	0.44 T	0.35 T	0.44 T
26	0.34 T	0.24 T	0.30 T	0.29 T	0.38 T
27	0.28 T	0.26 T	0.28 T	0.27 T	0.34 T
28	0.20 T	0.52 T	0.26 T	0.33 T	0.32 T
29	0.64 T	0.34 T	0.24 T	0.41 T	0.52 T
30	0.40 T	0.38 T	0.26 T	0.35 T	0.30 T
31	ND	ND	ND	ND	0.22 T
32	0.44 T	0.24 T	0.32 T	0.33 T	0.38 T
33	0.54 T	0.30 T	0.34 T	0.39 T	0.36 T
34	0.68 T	0.20 T	0.36 T	0.41 T	ND
35	0.36 T	ND	0.34 T	0.35 T	0.28 T
36	0.44 T	0.50 T	0.38 T	0.44 T	0.40 T
37	0.44 T	0.32 T	0.30 T	0.35 T	0.30 T
38	0.50 T	0.16 T	0.48 T	0.38 T	0.54 T
39	0.44 T	0.60 T	0.40 T	0.48 T	0.22 T
ULN	2	2	2		NG

NA - not analyzed
ND - no data
NG - no ULN guideline.

T -results are considered trace amounts
< -less than the smallest measurable amount for this analytical method

Table 8: Results of Chemical Analysis for Calcium in Silver Maple Foliage and Mossbags in the Vicinity of Tricil Ltd. , Corruna in 1989 and 1990 (all results are in ug/g dry weight)

	Soil	Maple Foliage	
St. No.	1989	1989	1990
1	NA	14000	12500
2	NA	12000	13000
3	NA	8800	14000
4	NA	13000	13000
6	NA	12000	15000
8	NA	9400	17000
11	NA	13000	13000
13	NA	20000	ND
15	NA	16000	16500
17	NA	10000	11000
20	NA	7000	9750
22	NA	11000	15000
23	NA	15000	20500
24	NA	20000	19000
27	NA	7600	11500
28	NA	12000	15500
29	NA	14000	ND
30	NA	12000	18500
31	NA	12000	15000
32	NA	16000	15000
ULN	NG	30000	30000

	Moss Bags				
St. No.	Jun-89	Jul-89	Aug-89	Mean-89	Jun-Aug/90
1	5500	5200	4300	5000	5900
2	4300	3700	4200	4067	4400
3	4600	3900	4200	4233	4200
4	3800	5000	4600	4467	7400
5	28000	11000	20000	19667	13000
6	13000	4600	8200	8600	ND
7	6400	3900	8100	6133	23000
8	4100	3600	4800	4167	10000
9	7600	4900	6800	6433	16000
10	3400	4800	4100	4100	9100
11	5500	9000	9900	8133	20000
12	9300	7500	13000	9933	38000
13	13000	7000	9900	9967	18000
14	4600	4400	4900	4633	13000
15	7700	10000	7200	8300	29000
16	6900	4900	7200	6333	9600
17	ND	10000	ND	10000	12000
18	7200	4200	5500	5633	8500
19	7000	5600	14000	8867	17000
20	4500	3800	4500	4267	5400
21	8800	4400	6200	6467	5000
22	3800	3900	5400	4367	4500
23	7300	9500	9700	8833	16000
24	4100	4100	5400	4533	5500
25	ND	4700	5200	4950	5900
26	7800	8700	9000	8500	12000
27	6700	4700	5400	5600	5400
28	12000	14000	13000	13000	17000
29	5800	7100	6700	6533	7000
30	6600	4300	5600	5500	7600
31	ND	ND	ND	ND	9500
32	4500	5000	5200	4900	7100
33	4900	4500	6900	5433	6700
34	4600	4400	5400	4800	ND
35	6800	ND	18000	12400	31000
36	5300	28000	10000	14433	10000
37	38000	5200	4900	16033	7800
38	6600	25000	31000	20867	7600
39	3200	5100	5800	4700	72000
ULN	NG	NG	NG		NG

ND - no data NA - not analyzed
NG - no ULN guideline.

Table 9: Results of Chemical Analysis for Chloride in Soil, Silver Maple Foliage and Mossbags in the Vicinity of Tricil Ltd. , Corruna in 1989 and 1990 (all results are in ug/g dry weight for soil and moss bags, and percent dry weight for vegetation)

	Soil	Maple Foliage	
St. No.	1989	1989	1990
1	28	0.41	0.12
2	26	0.24	0.27
3	26	0.22	0.74
4	7.2	0.08	0.09
6	30	0.40	0.34
8	14	0.22	0.43
11	28	0.63	0.57
13	18	0.13	ND
15	36	0.30	0.04
17	22	0.05	0.10
20	22	0.06	0.10
22	27	0.10	0.13
23	17	0.42	0.30
24	23	0.54	0.35
27	17	0.11	0.08
28	25	0.64	0.59
29	28	0.28	ND
30	20	0.04	0.31
31	11	0.08	0.10
32	22	0.55	0.26
ULN	NG	0.15	0.15

	Moss Bags				
St. No.	Jun-89	Jul-89	Aug-89	Mean-89	Jun-Aug/90
1	IS	IS	IS	IS	220
2	IS	IS	IS	IS	320
3	IS	IS	IS	IS	220
4	IS	IS	IS	IS	180 T
5	IS	IS	IS	IS	120 T
6	IS	IS	IS	IS	ND
7	IS	IS	IS	IS	2000
8	IS	IS	IS	IS	100 T
9	IS	IS	IS	IS	120 T
10	IS	IS	IS	IS	10 T
11	IS	IS	IS	IS	40 T
12	IS	IS	IS	IS	180 T
13	IS	IS	IS	IS	100 T
14	IS	IS	IS	IS	260
15	IS	IS	IS	IS	220
16	IS	IS	IS	IS	60 T
17	IS	IS	IS	IS	80 T
18	IS	IS	IS	IS	440
19	IS	IS	IS	IS	300
20	IS	IS	IS	IS	160 T
21	IS	IS	IS	IS	180 T
22	IS	IS	IS	IS	100 T
23	IS	IS	IS	IS	400
24	IS	IS	IS	IS	180 T
25	IS	IS	IS	IS	140 T
26	IS	IS	IS	IS	180 T
27	IS	IS	IS	IS	240
28	IS	IS	IS	IS	260
29	IS	IS	IS	IS	140 T
30	IS	IS	IS	IS	40 T
31	IS	IS	IS	IS	240
32	IS	IS	IS	IS	80 T
33	IS	IS	IS	IS	140 T
34	IS	IS	IS	IS	ND
35	IS	IS	IS	IS	360
36	IS	IS	IS	IS	320
37	IS	IS	IS	IS	180 T
38	IS	IS	IS	IS	60 T
39	IS	IS	IS	IS	10 T
ULN	300	300	300		NG

IS - insufficient sample for analysis
NA - not analyzed
ND - no data
NG - no ULN guideline.

T -results are considered trace amounts
< -less than the smallest measurable amount for this analytical method

Table 10 Results of Chemical Analysis for Chromium in Soil, Silver Maple Foliage and Mossbags in the Vicinity of Tricil Ltd. , Corruna in 1989 and 1990 (all results are in ug/g dry weight)

	Soil	Maple Foliage	
St. No.	1989	1989	1990
1	36	0.8 T	<0.5
2	31	1.2 T	<0.5
3	32	0.6 T	<0.5
4	33	0.7 T	<0.5
6	30	1.6 T	<0.5
8	16	0.7 T	<0.5
11	28	0.9 T	<0.5
13	34	1.5 T	ND
15	24	2.6 T	1.0 T
17	35	0.9 T	<0.5
20	29	0.7 T	<0.5
22	26	1.0 T	<0.5
23	26	1.1 T	<0.5
24	26	1.3 T	<0.5
27	32	0.5 T	<0.5
28	28	1.3 T	<0.5
29	30	1.0 T	ND
30	20	0.9 T	<0.5
31	20	0.9 T	<0.5
32	26	1.2 T	<0.5
ULN	50	8	8

	Moss Bags				
St. No.	Jun-89	Jul-89	Aug-89	Mean-89	Jun-Aug/90
1	1.4 T	1.6 T	2.2 T	1.7 T	2.5 T
2	1.5 T	1.9 T	2.6 T	2.0 T	2.4 T
3	1.4 T	3.4 T	2.6 T	2.5 T	2.3 T
4	1.7 T	2.5 T	2.4 T	2.2 T	2.3 T
5	2.5 T	2.5 T	2.8 T	2.6 T	2.9 T
6	1.7 T	2.1 T	3.0 T	2.3 T	ND
7	1.7 T	2.4 T	3.2 T	2.4 T	4.0 T
8	1.7 T	2.1 T	2.8 T	2.2 T	4.1 T
9	2.1 T	3.0 T	2.8 T	2.6 T	6.1
10	1.4 T	2.7 T	2.4 T	2.2 T	3.7 T
11	1.3 T	2.9 T	2.6 T	2.3 T	3.7 T
12	1.6 T	2.9 T	3.4 T	2.6 T	4.1 T
13	2.7 T	2.7 T	2.6 T	2.7 T	3.5 T
14	1.8 T	2.1 T	2.4 T	2.1 T	3.9 T
15	3.0 T	4.9 T	3.4 T	3.8 T	7.9
16	1.8 T	2.0 T	3.0 T	2.3 T	4.5 T
17	ND	2.3 T	ND	2.3 T	4.0 T
18	2.0 T	1.7 T	2.4 T	2.0 T	3.9 T
19	1.7 T	2.2 T	2.7 T	2.2 T	2.9 T
20	1.8 T	2.0 T	2.2 T	2.0 T	3.1 T
21	1.8 T	2.0 T	2.6 T	2.1 T	3.3 T
22	1.6 T	2.4 T	2.4 T	2.1 T	3.2 T
23	1.8 T	2.7 T	2.8 T	2.4 T	4.5 T
24	1.6 T	1.9 T	2.7 T	2.1 T	3.2 T
25	ND	2.3 T	2.2 T	2.3 T	2.8 T
26	1.9 T	2.6 T	2.4 T	2.3 T	3.8 T
27	1.7 T	2.6 T	2.3 T	2.2 T	4.0 T
28	2.0 T	2.8 T	2.9 T	2.6 T	3.9 T
29	2.3 T	3.8 T	2.7 T	2.9 T	3.7 T
30	1.7 T	2.6 T	2.1 T	2.1 T	2.5 T
31	ND	ND	ND	ND	3.3 T
32	2.1 T	2.6 T	2.8 T	2.5 T	3.9 T
33	1.9 T	2.5 T	2.8 T	2.4 T	4.7 T
34	1.6 T	2.5 T	2.8 T	2.3 T	ND
35	2.4 T	ND	4.7 T	3.6 T	6.4
36	1.6 T	13.0	3.6 T	6.1	3.8 T
37	4.3 T	4.0 T	3.3 T	3.9 T	3.2 T
38	1.6 T	3.6 T	4.2 T	3.1 T	5.3
39	2.0 T	3.5 T	2.5 T	2.7 T	5.3
ULN	NG	NG	NG		NG

NA - not analyzed
ND - no data
NG - no ULN guideline.

T - all results below 5.0 ug/g are considered trace amounts
< -less than the smallest measurable amount for this analytical method

Table 11 Results of Chemical Analysis for Cobalt in Soil, Silver Maple Foliage and Mossbags in the Vicinity of Tricil Ltd. , Corruna in 1989 and 1990 (all results are in ug/g dry weight)

	Soil	Maple Foliage	
St. No.	1989	1989	1990
1	14	<0.2	<0.2
2	12	<0.2	<0.2
3	12	<0.2	<0.2
4	12	<0.2	<0.2
6	10	<0.2	<0.2
8	6	<0.2	<0.2
11	9	<0.2	<0.2
13	11	<0.2	ND
15	9	0.3 T	<0.2
17	12	<0.2	<0.2
20	12	<0.2	<0.2
22	9	<0.2	<0.2
23	9	<0.2	<0.2
24	9	<0.2	<0.2
27	11	<0.2	<0.2
28	10	0.5 T	<0.2
29	10	0.5 T	ND
30	8	<0.2	<0.2
31	7	<0.2	<0.2
32	8	<0.2	<0.2
ULN	25	2	2

	Moss Bags				
St. No.	Jun-89	Jul-89	Aug-89	Mean-89	Jun-Aug/90
1	1.1 T	1.2 T	1.2 T	1.2 T	0.9 T
2	1.1 T	1.1 T	1.2 T	1.1 T	0.8 T
3	1.2 T	1.3 T	1.2 T	1.2 T	0.8 T
4	1.0 T	1.2 T	1.1 T	1.1 T	1.0 T
5	1.4 T	1.3 T	1.3 T	1.3 T	0.9 T
6	1.2 T	1.1 T	1.3 T	1.2 T	ND
7	1.3 T	1.1 T	1.1 T	1.2 T	1.0 T
8	1.1 T	1.2 T	1.6 T	1.3 T	1.6 T
9	1.2 T	1.3 T	1.2 T	1.2 T	1.4 T
10	1.0 T	1.1 T	1.1 T	1.1 T	1.4 T
11	1.0 T	1.2 T	1.4 T	1.2 T	1.3 T
12	1.1 T	1.6 T	1.2 T	1.3 T	1.3 T
13	1.3 T	1.4 T	1.2 T	1.3 T	1.5 T
14	1.1 T	1.3 T	1.2 T	1.2 T	1.5 T
15	1.0 T	1.6 T	1.2 T	1.3 T	1.6 T
16	1.3 T	1.1 T	1.3 T	1.2 T	1.1 T
17	ND	1.4 T	ND	1.4 T	1.0 T
18	1.4 T	1.1 T	1.3 T	1.3 T	1.1 T
19	1.1 T	1.2 T	1.2 T	1.2 T	0.9 T
20	1.0 T	1.1 T	1.1 T	1.1 T	1.3 T
21	1.2 T	1.1 T	1.4 T	1.2 T	1.0 T
22	1.1 T	1.2 T	1.2 T	1.2 T	1.1 T
23	1.3 T	1.3 T	1.4 T	1.3 T	1.3 T
24	1.1 T	1.1 T	1.6 T	1.3 T	1.1 T
25	ND	1.1 T	1.3 T	1.2 T	1.0 T
26	1.1 T	1.3 T	1.2 T	1.2 T	1.1 T
27	1.4 T	1.2 T	1.4 T	1.3 T	1.2 T
28	1.3 T	1.6 T	1.4 T	1.4 T	1.2 T
29	1.6 T	1.3 T	1.3 T	1.4 T	1.4 T
30	1.1 T	1.2 T	1.1 T	1.1 T	1.3 T
31	ND	ND	ND	ND	1.5 T
32	1.3 T	1.3 T	1.4 T	1.3 T	1.2 T
33	1.1 T	1.2 T	1.4 T	1.2 T	1.3 T
34	1.0 T	1.2 T	1.7 T	1.3 T	ND
35	1.2 T	ND	1.2 T	1.2 T	1.2 T
36	1.1 T	5.9	1.2 T	2.7	1.3 T
37	1.5 T	1.3 T	1.4 T	1.4 T	1.0 T
38	1.0 T	1.2 T	1.4 T	1.2 T	1.1 T
39	1.2 T	1.3 T	1.2 T	1.2 T	1.0 T
ULN	300	300	300		NG

IS - insufficient sample for analysis
NA - not analyzed
ND - no data
NG - no ULN guideline.

T - all results below 2.0 ug/g are considered trace amounts
< -less than the smallest measurable amount for this analytical method

Table 12 Results of Chemical Analysis for Copper in Soil, Silver Maple Foliage and Mossbags in the Vicinity of Tricil Ltd. , Corruna in 1989 and 1990 (all results are in ug/g dry weight)

	Soil	Maple Foliage	
St. No.	1989	1989	1990
1	52	4.6 T	4.7 T
2	44	3.8 T	3.3 T
3	49	4.4 T	12.0
4	52	6.0	7.1
6	40	6.0	6.7
8	17	4.8 T	6.2
11	44	4.0 T	5.7
13	52	6.4	ND
15	28	7.4	6.8
17	42	5.6	7.0
20	40	6.6	6.4
22	36	10.0	8.1
23	24	5.9	7.5
24	24	7.3	9.1
27	54	8.9	7.0
28	30	6.7	8.8
29	42	7.3	ND
30	18	5.6	6.5
31	23	5.6	6.6
32	36	3.9 T	3.8 T
ULN	60	20	20

	Moss Bags				
St. No.	Jun-89	Jul-89	Aug-89	Mean-89	Jun-Aug/90
1	5.1	5.3	5.0	5.1	5.6
2	4.8 T	4.3 T	5.1	4.7 T	5.2
3	5.3	5.8	4.8 T	5.3	5.8
4	4.2 T	4.1 T	5.3	4.5 T	5.1
5	5.6	4.6 T	5.9	5.4	12.0
6	4.8 T	4.8 T	5.8	5.1	ND
7	15.0	11.0	7.1	11.0	7.8
8	4.4 T	5.2	6.6	5.4	9.4
9	5.2	5.4	5.3	5.3	11.0
10	4.4 T	3.9 T	5.7	4.7 T	7.8
11	5.5	7.7	11.0	8.1	15.0
12	4.9 T	5.7	5.5	5.4	8.4
13	5.6	5.5	6.1	5.7	9.6
14	4.6 T	5.4	5.6	5.2	9.5
15	6.3	7.2	6.3	6.6	11.0
16	5.4	6.8	6.3	6.2	8.3
17	ND	6.0	ND	6.0	7.8
18	7.6	14.0	6.1	9.2	23.0
19	4.7 T	6.3	5.8	5.6	5.9
20	5.3	5.4	4.7 T	5.1	5.7
21	5.3	5.9	5.5	5.6	7.6
22	4.9 T	5.5	5.1	5.2	6.5
23	5.2	6.4	5.6	5.7	8.5
24	4.7 T	5.7	5.3	5.2	7.0
25	ND	7.1	6.0	6.6	6.9
26	6.6	35.0	7.3	16.3	32.0
27	4.4 T	5.4	5.2	5.0	6.7
28	4.4 T	6.3	5.2	5.3	7.3
29	5.9	6.3	6.0	6.1	7.5
30	6.9	17.0	6.2	10.0	70.0
31	6.3	ND	5.4	5.9	6.9
32	5.7	6.5	5.8	6.0	8.1
33	4.4 T	5.9	6.3	5.5	8.1
34	2.7 T	5.7	6.3	4.9 T	ND
35	5.7	ND	5.3	5.5	8.9
36	4.5 T	11.0	6.4	7.3	8.6
37	5.1	5.6	5.7	5.5	6.4
38	13.0	6.1	5.6	8.2	26.0
39	4.2 T	10.0	6.5	6.9	9.0
ULN	8	8	8		NG

NA - not analyzed
ND - no data
NG - no ULN guideline.

T - all results below 5.0 ug/g are considered trace amounts
< -less than the smallest measurable amount for this analytical method

Table 13 Results of Chemical Analysis for Fluoride in Silver Maple Foliage and Mossbags in the Vicinity of Tricil Ltd. , Corruna in 1989 and 1990 (all results are in ug/g dry weight)

	Soil	Maple Foliage	
St. No.	1989	1989	1990
1	NA	7.8	2.9 T
2	NA	7.4	2.8 T
3	NA	8.8	3.6 T
4	NA	11.0	3.7 T
6	NA	8.0	3.8 T
8	NA	7.2	3.3 T
11	NA	9.6	4.0 T
13	NA	10.0	ND
15	NA	10.0	4.7 T
17	NA	7.2	3.5 T
20	NA	5.8	3.4 T
22	NA	8.8	3.7 T
23	NA	8.6	4.0 T
24	NA	12.0	5.0
27	NA	6.6	2.9 T
28	NA	12.0	4.2 T
29	NA	6.0	ND
30	NA	7.2	3.7 T
31	NA	6.8	3.9 T
32	NA	4.6 T	3.6 T
ULN	NG	15	15

	Moss Bags				
St. No.	Jun-89	Jul-89	Aug-89	Mean-89	Jun-Aug/90
1	8	14	13	12	19
2	14	14	15	14	20
3	7	13	12	11	15
4	8	15	14	12	22
5	38	23	33	31	24
6	21	15	18	18	ND
7	11	11	22	15	64
8	13	11	15	13	33
9	12	14	21	16	47
10	6	12	12	10	22
11	9	19	21	16	33
12	15	16	22	18	50
13	21	20	26	22	25
14	14	17	19	17	43
15	20	29	23	24	65
16	15	12	26	18	28
17	ND	20	ND	20	27
18	17	12	19	16	34
19	12	14	26	17	32
20	12	10	15	12	27
21	14	11	17	14	18
22	9	7	16	11	19
23	12	22	26	20	49
24	9	8	16	11	20
25	ND	13	15	14	23
26	17	22	25	21	44
27	15	14	18	16	25
28	24	25	29	26	42
29	11	17	20	16	24
30	15	11	14	13	15
31	15	12	16	14	25
32	9	17	17	14	27
33	11	14	19	15	29
34	10	11	17	13	ND
35	17	ND	37	27	55
36	10	64	24	33	37
37	32	15	17	21	28
38	16	35	41	31	24
39	11	14	20	15	47
ULN	45	45	45		NG

NA - not analyzed
ND - no data
NG - no ULN guideline.

T - all results below 5.0 ug/g are considered trace amounts
< -less than the smallest measurable amount for this analytical method

Table 14: Results of Chemical Analysis for Iron in Soil, Silver Maple Foliage and Mossbags in the Vicinity of Tricil Ltd. , Corruna in 1989 and 1990 (all results are in ug/g dry weight)

	Soil	Maple Foliage	
St. No.	1989	1989	1990
1	26000	120	155
2	18000	94	99
3	20000	105	170
4	19000	120	140
6	18000	106	155
8	9700	98	135
11	16000	180	180
13	20000	185	ND
15	16000	160	230
17	22000	120	175
20	20000	100	155
22	16000	170	120
23	16000	200	150
24	16000	180	180
27	20000	86	122
28	18000	160	145
29	16000	88	ND
30	14000	120	145
31	10000	110	130
32	11000	140	140
ULN	35000	500	500

	Moss Bags				
St. No.	Jun-89	Jul-89	Aug-89	Mean-89	Jun-Aug/90
1	850	900	1100	950	1300
2	970	1000	1200	1060	1400
3	810	1300	1200	1100	1200
4	1000	1300	1100	1130	1300
5	1400	1300	1500	1400	1400
6	980	1100	1300	1130	ND
7	940	1100	1300	1110	1900
8	1100	990	1200	1100	2000
9	1000	1100	1200	1100	2300
10	920	1200	1100	1070	1800
11	840	1300	1300	1150	1600
12	1000	1200	1400	1200	2000
13	1400	1400	1200	1330	1700
14	1000	1300	1200	1170	1600
15	990	1400	1200	1200	2900
16	1200	860	1300	1120	1800
17	ND	1200	ND	1200	1800
18	1100	830	1200	1040	1900
19	890	970	1000	950	1300
20	950	920	1100	990	1700
21	1000	860	1400	1090	1700
22	940	910	1300	1050	1600
23	1100	1200	1300	1200	2200
24	1100	930	1100	1040	1600
25	ND	1000	1000	1000	1500
26	1100	1200	1100	1130	1600
27	960	960	1400	1110	1600
28	1200	1200	1200	1200	1900
29	1200	1200	1200	1200	1800
30	1000	1000	1200	1070	1100
31	1100	ND	1200	1150	1100
32	950	1100	1200	1080	1600
33	1200	1000	1200	1130	2200
34	1100	980	1100	1060	ND
35	1000	ND	1300	1150	1800
36	990	1200	1200	1130	1800
37	1300	1200	1300	1270	1400
38	1000	1100	1400	1170	1700
39	1100	960	1100	1050	2000
ULN	1700	1700	1700		NG

ND - no data NA - not analyzed IS - insufficient sample for analysis
NG - no ULN guideline.

Table 15 Results of Chemical Analysis for Lead in Soil, Silver Maple Foliage and Mossbags in the Vicinity of Tricil Ltd., Corruna in 1989 and 1990 (all results are in ug/g dry weight)

	Soil	Maple Foliage	
St. No.	1989	1989	1990
1	33	1.1 T	0.7 T
2	73	0.5 T	1.1 T
3	22	0.5 T	0.8 T
4	17 T	1.0 T	2.0 T
6	34	0.5 T	0.9 T
8	18 T	0.5 T	1.0 T
11	34	1.8 T	2.3 T
13	22	1.2 T	ND
15	46	2.6 T	2.6 T
17	40	0.9 T	1.1 T
20	39	1.2 T	0.8 T
22	32	1.6 T	0.6 T
23	22	2.0 T	1.2 T
24	24	2.4 T	1.0 T
27	22	0.5 T	0.5 T
28	23	2.4 T	1.0 T
29	24	1.2 T	ND
30	32	1.2 T	1.0 T
31	29	1.4 T	0.9 T
32	22	1.0 T	0.5 T
ULN	150	30	30

	Moss Bags				
St. No.	Jun-89	Jul-89	Aug-89	Mean-89	Jun-Aug/90
1	31	46	26	34	42
2	32	36	27	32	41
3	32	33	27	31	39
4	31	34	28	31	42
5	24	29	30	28	32
6	27	34	31	31	ND
7	30	36	28	31	32
8	31	27	35	31	36
9	28	65	33	42	32
10	32	38	27	32	38
11	29	34	29	31	25
12	28	31	33	31	26
13	33	31	29	31	35
14	31	29	29	30	31
15	30	33	33	32	48
16	35	33	29	32	47
17	ND	36	ND	36	44
18	30	34	28	31	41
19	27	33	24	28	37
20	26	36	27	30	43
21	24	33	34	30	40
22	32	33	29	31	42
23	36	36	31	34	42
24	32	34	30	32	43
25	ND	31	28	30	38
26	55	34	27	39	41
27	24	30	26	27	41
28	28	45	28	34	38
29	32	37	26	32	45
30	29	33	26	29	26
31	25	ND	29	27	22
32	30	28	28	29	37
33	35	38	36	36	37
34	28	30	31	30	ND
35	24	ND	28	26	26
36	28	12	31	24	38
37	25	33	34	31	38
38	30	28	28	29	50
39	31	35	29	32	25
ULN	35	35	35		NG

NA - not analyzed
ND - no data
NG - no ULN guideline.

T -results are considered trace amounts
< -less than the smallest measurable amount for this analytical method

Table 16: Results of Chemical Analysis for Magnesium in Silver Maple Foliage and Mossbags in the Vicinity of Tricil Ltd. , Corruna in 1989 and 1990 (all results are in ug/g dry weight)

	Soil	Maple Foliage	
St. No.	1989	1989	1990
1	NA	2800	2950
2	NA	3700	3600
3	NA	3200	3000
4	NA	4600	4800
6	NA	3000	3800
8	NA	2400	3450
11	NA	2700	2650
13	NA	4200	ND
15	NA	4400	3650
17	NA	3300	3250
20	NA	2600	3150
22	NA	2800	2950
23	NA	2600	4400
24	NA	3600	4150
27	NA	2200	2950
28	NA	3600	3800
29	NA	2900	ND
30	NA	3200	3500
31	NA	3500	3300
32	NA	3200	3400
ULN	10000	7000	7000

	Moss Bags				
St. No.	Jun-89	Jul-89	Aug-89	Mean-89	Jun-Aug/90
1	1600	1500	1400	1500	1900
2	1100	1000	1100	1067	1200
3	1500	1200	1500	1400	1200
4	1100	1900	1500	1500	2700
5	7100	2200	4600	4633	4500
6	2700	1100	1800	1867	ND
7	2300	1000	3700	2333	7700
8	1000	1000	1100	1033	1800
9	2900	1400	2600	2300	4800
10	880	1500	1100	1160	2700
11	2000	3700	3700	3133	7000
12	2000	1800	3000	2267	9700
13	4400	2000	2900	3100	4200
14	1200	1200	1500	1300	3300
15	2200	2400	2200	2267	9700
16	1800	1100	2300	1733	2500
17	ND	2100	ND	2100	2800
18	1700	980	1400	1360	2100
19	2700	1800	6200	3567	8200
20	1100	890	1100	1030	1200
21	2200	1100	1700	1667	1500
22	930	1000	1300	1077	1200
23	1400	1800	2000	1733	3100
24	990	1000	1500	1163	1400
25	ND	1100	1300	1200	1200
26	1400	1700	1700	1600	2900
27	1600	1200	1400	1400	1300
28	2100	2500	4700	3100	3200
29	1500	1700	1800	1667	1700
30	2000	1200	1800	1667	1500
31	2200	ND	1800	2000	2600
32	1100	1200	1300	1200	1500
33	1200	1000	1900	1367	1300
34	1200	1100	1300	1200	ND
35	1700	ND	8300	5000	15000
36	1300	11000	3400	5233	2400
37	19000	1500	1300	7267	2000
38	1400	13000	16000	10133	1700
39	900	1200	1300	1133	41000
ULN	NG	NG	NG		NG

ND - no data NA - not analyzed IS - insufficient sample for analysis
NG - no ULN guideline.

Table 17: Results of Chemical Analysis for Manganese in Soil, Silver Maple Foliage and Mossbags in the Vicinity of Tricil Ltd. , Corruna in 1989 and 1990 (all results are in ug/g dry weight)

	Soil	Maple Foliage	
St. No.	1989	1989	1990
1	470	52	75
2	400	20	14
3	380	10	51
4	360	25	23
6	270	70	80
8	160	23	120
11	250	30	33
13	240	180	ND
15	220	29	39
17	400	32	29
20	360	28	41
22	200	30	18
23	210	26	79
24	230	82	98
27	210	9.2	22
28	360	26	33
29	200	16	ND
30	180	14	24
31	280	11	14
32	240	41	22
ULN	700	NG	NG

	Moss Bags				
St. No.	Jun-89	Jul-89	Aug-89	Mean-89	Jun-Aug/90
1	100	110	130	113	100
2	84	110	140	111	100
3	99	110	130	113	91
4	88	98	130	105	81
5	120	100	130	117	200
6	100	120	120	113	ND
7	92	130	130	117	130
8	74	140	130	115	200
9	100	130	120	117	170
10	96	95	130	107	200
11	87	99	150	112	200
12	100	110	150	120	160
13	99	120	140	120	190
14	82	140	150	124	230
15	98	140	130	123	140
16	95	230	110	145	130
17	ND	220	ND	220	140
18	110	220	130	153	150
19	81	240	130	150	78
20	85	220	120	142	82
21	100	220	170	163	91
22	88	240	120	149	99
23	90	230	140	153	150
24	85	230	120	145	160
25	ND	230	140	185	99
26	110	240	130	160	130
27	110	260	130	167	120
28	85	230	140	152	100
29	110	240	130	160	120
30	110	190	110	137	260
31	130	ND	120	125	270
32	100	240	130	157	150
33	82	230	140	151	96
34	110	240	130	160	ND
35	110	ND	110	110	180
36	90	240	120	150	170
37	92	240	100	144	170
38	90	230	120	147	130
39	100	230	110	147	110
ULN	NG	NG	NG		NG

ND - no data NA - not analyzed
NG - no ULN guideline.

Table 18 Results of Chemical Analysis for Mercury in Silver Maple Foliage and Mossbags in the Vicinity of Tricil Ltd. , Corruna in 1989 and 1990 (all results are in ug/g dry weight)

	Soil	Maple Foliage	
St. No.	1989	1989	1990
1	NA	0.04 T	<0.01
2	NA	0.04 T	0.02 T
3	NA	0.03 T	0.05 T
4	NA	0.06 T	0.04 T
6	NA	0.05 T	0.03 T
8	NA	0.03 T	0.04 T
11	NA	0.04 T	0.05 T
13	NA	0.04 T	ND
15	NA	0.04 T	0.05 T
17	NA	0.04 T	0.05 T
20	NA	0.03 T	0.03 T
22	NA	0.04 T	0.03 T
23	NA	0.03 T	0.02 T
24	NA	0.04 T	0.04 T
27	NA	0.04 T	0.02 T
28	NA	0.05 T	<0.01
29	NA	0.04 T	ND
30	NA	0.03 T	<0.01
31	NA	0.05 T	<0.01
32	NA	0.04 T	<0.01
ULN	0.15	0.1	0.1

	Moss Bags				
St. No.	Jun-89	Jul-89	Aug-89	Mean-89	Jun-Aug/90
1	0.10	0.18	0.15	0.14	0.20
2	0.09 T	0.13	0.20	0.14	0.16
3	0.14	0.10	0.11	0.12	0.17
4	0.09 T	0.08 T	0.14	0.10	0.17
5	0.08 T	0.11	0.11	0.10	0.15
6	0.10	0.09 T	0.20	0.13	ND
7	0.10	0.10	**0.22**	0.14	0.17
8	0.16	0.10	0.17	0.14	0.22
9	0.10	0.09 T	0.16	0.12	0.19
10	0.14	0.11	0.11	0.12	0.11
11	0.13	0.07 T	0.12	0.11	0.16
12	0.16	0.07 T	0.13	0.12	0.16
13	0.16	0.08 T	0.10	0.11	0.16
14	0.16	0.07 T	0.12	0.12	0.19
15	0.15	0.10	0.20	0.15	0.20
16	0.14	0.12	0.18	0.15	0.21
17	ND	0.13	ND	0.13	0.16
18	0.14	0.13	0.15	0.14	0.25
19	0.13	0.12	0.13	0.13	0.14
20	0.09 T	0.13	0.13	0.12	0.13
21	0.13	0.13	0.09 T	0.12	0.12
22	0.18	0.10	0.11	0.13	0.16
23	0.17	0.10	0.14	0.14	0.15
24	0.10	0.08 T	**0.21**	0.13	0.18
25	ND	0.09 T	0.14	0.12	0.13
26	0.16	0.06 T	0.10	0.11	0.14
27	0.12	0.09 T	0.12	0.11	0.17
28	0.10	0.07 T	0.07 T	0.08 T	0.17
29	0.17	0.08 T	0.13	0.13	0.16
30	0.11	0.08 T	0.09 T	0.09 T	0.11
31	0.15	0.07 T	0.10	0.11	0.11
32	0.12	0.13	0.11	0.12	0.12
33	0.17	0.16	0.16	0.16	0.15
34	0.18	0.15	0.11	0.15	ND
35	0.13	ND	0.10	0.12	0.17
36	0.19	0.07 T	0.15	0.14	0.24
37	0.13	0.15	0.17	0.15	0.14
38	0.12	0.15	0.14	0.14	0.19
39	0.17	0.14	0.19	0.17	0.17
ULN	0.2	0.2	0.2		NG

NA - not analyzed
ND - no data
NG - no ULN guideline.

T - all results below 0.1 ug/g are considered trace amounts
< -less than the smallest measurable amount for this analytical method

Table 19 Results of Chemical Analysis for Molybdenum in Soil, Silver Maple Foliage and Mossbags in the Vicinity of Tricil Ltd. , Corruna in 1989 and 1990 (all results are in ug/g dry weight)

	Soil	Maple Foliage	
St. No.	1989	1989	1990
1	1.8 T	<0.2	<0.2
2	0.7 T	<0.2	<0.2
3	0.9 T	0.4 T	<0.2
4	1.2 T	<0.2	0.3 T
6	1.2 T	<0.2	<0.2
8	1.2 T	<0.2	<0.2
11	1.2 T	<0.2	0.3 T
13	0.9 T	<0.2	ND
15	1.0 T	0.4 T	<0.2
17	1.6 T	<0.2	<0.2
20	2.0	0.3 T	<0.2
22	1.3 T	<0.2	<0.2
23	1.1 T	0.3 T	0.3 T
24	1.0 T	0.3 T	0.4 T
27	1.4 T	<0.2	0.2 T
28	1.8 T	0.9 T	0.4 T
29	1.3 T	1 T	ND
30	1.3 T	0.3 T	0.3 T
31	0.6 T	0.4 T	0.4 T
32	0.9 T	<0.2	0.3 T
ULN	2	1.5	1.5

	Moss Bags				
St. No.	Jun-89	Jul-89	Aug-89	Mean-89	Jun-Aug/90
1	0.3 T	0.5 T	0.5 T	0.4 T	0.3 T
2	0.6 T	0.4 T	0.9 T	0.6 T	0.6 T
3	0.5 T	0.5 T	0.9 T	0.6 T	0.4 T
4	0.7 T	0.6 T	0.7 T	0.7 T	0.5 T
5	1.1 T	1.0 T	0.9 T	1.0 T	0.3 T
6	0.6 T	0.6 T	0.7 T	0.6 T	ND
7	1.4 T	0.5 T	1.0 T	1.0 T	0.3 T
8	1.1 T	0.5 T	1.3 T	1.0 T	0.8 T
9	0.7 T	0.6 T	1.0 T	0.8 T	0.6 T
10	0.8 T	0.8 T	0.8 T	0.8 T	0.7 T
11	0.8 T	0.8 T	1.0 T	0.9 T	0.1 T
12	0.4 T	1.2 T	1.0 T	0.9 T	0.3 T
13	1.1 T	0.7 T	1.1 T	1.0 T	0.5 T
14	0.8 T	0.7 T	0.7 T	0.7 T	0.7 T
15	0.3 T	0.9 T	1.0 T	0.7 T	0.6 T
16	0.7 T	0.7 T	0.9 T	0.8 T	0.4 T
17	ND	0.8 T	ND	0.8 T	0.4 T
18	1.5 T	0.6 T	0.3 T	0.8 T	0.3 T
19	0.9 T	0.8 T	0.6 T	0.8 T	0.3 T
20	0.7 T	0.7 T	0.6 T	0.7 T	0.3 T
21	0.9 T	0.8 T	0.3 T	0.7 T	0.1 T
22	0.7 T	0.9 T	0.4 T	0.7 T	0.1 T
23	0.5 T	0.7 T	0.6 T	0.6 T	0.4 T
24	0.5 T	0.8 T	1.4 T	0.9 T	0.1 T
25	ND	0.9 T	0.6 T	0.8 T	0.1 T
26	0.7 T	1.1 T	0.4 T	0.7 T	0.3 T
27	0.6 T	0.8 T	0.4 T	0.6 T	0.1 T
28	1.0 T	1.5 T	0.4 T	1.0 T	0.1 T
29	1.4 T	1.1 T	0.5 T	1.0 T	0.7 T
30	1.1 T	1.0 T	0.4 T	0.8 T	0.1 T
31	1.0 T	ND	0.4 T	0.7 T	0.3 T
32	0.8 T	1.2 T	0.4 T	0.8 T	0.3 T
33	0.3 T	0.9 T	0.5 T	0.6 T	0.3 T
34	0.3 T	0.8 T	1.4 T	0.8 T	ND
35	0.4 T	ND	0.6 T	0.5 T	0.1 T
36	0.4 T	1.0 T	0.6 T	0.7 T	0.4 T
37	1.3 T	1.1 T	0.3 T	0.9 T	0.1 T
38	0.5 T	1.0 T	0.8 T	0.8 T	0.1 T
39	0.6 T	1.5 T	0.5 T	0.9 T	0.4 T
ULN	NG	NG	NG		NG

NA - not analyzed
ND - no data
NG - no ULN guideline.

T - all results below 2.0 ug/g are considered trace amounts
< -less than the smallest measurable amount for this analytical method

Table 20 Results of Chemical Analysis for Nickel in Soil, Silver Maple Foliage and Mossbags in the Vicinity of Tricil Ltd. , Corruna in 1989 and 1990 (all results are in ug/g dry weight)

	Soil	Maple Foliage	
St. No.	1989	1989	1990
1	34	<0.5	1.0 T
2	23	<0.5	1.1 T
3	26	<0.5	1.6 T
4	25	<0.5	1.2 T
6	24	<0.5	1.2 T
8	12	<0.5	1.3 T
11	24	<0.5	1.2 T
13	27	1.0 T	ND
15	20	<0.5	1.7 T
17	26	<0.5	1.1 T
20	22	<0.5	1.1 T
22	20	0.7 T	1.3 T
23	20	<0.5	1.5 T
24	20	1.1 T	1.5 T
27	31	<0.5	1.2 T
28	22	0.9 T	1.5 T
29	25	0.9 T	ND
30	16	<0.5	1.5 T
31	16	<0.5	1.3 T
32	23	0.9 T	1.4 T
ULN	60	5	5

	Moss Bags				
St. No.	Jun-89	Jul-89	Aug-89	Mean-89	Jun-Aug/90
1	3.6 T	31.0	4.2 T	12.9	3.6 T
2	4.5 T	4.1 T	4.2 T	4.3 T	3.3 T
3	2.7 T	3.4 T	4.4 T	3.5 T	3.7 T
4	3.0 T	4.6 T	4.0 T	3.9 T	3.7 T
5	3.3 T	3.5 T	5.8	4.2 T	5.9
6	2.8 T	14.0	4.0 T	6.9	ND
7	13.0	4.2 T	4.1 T	7.1	4.8 T
8	3.1 T	3.4 T	4.4 T	3.6 T	6.5
9	3.0 T	59.0	4.2 T	22.1	7.0
10	2.9 T	4.2 T	8.5	5.2	6.5
11	2.5 T	4.6 T	4.5 T	3.9 T	6.0
12	2.8 T	4.5 T	4.5 T	3.9 T	7.0
13	4.4 T	5.7	5.4	5.2	8.7
14	3.5 T	3.9 T	4.7 T	4.0 T	6.9
15	3.3 T	5.9	4.9 T	4.7 T	8.5
16	3.3 T	3.8 T	4.3 T	3.8 T	5.8
17	ND	4.2 T	ND	4.2 T	6.2
18	3.4 T	4.2 T	4.3 T	4.0 T	5.3
19	2.7 T	4.0 T	4.3 T	3.7 T	4.8 T
20	4.0 T	4.3 T	7.8	5.4	4.7 T
21	3.1 T	3.9 T	4.9 T	4.0 T	4.9 T
22	3.0 T	5.8	5.1	4.6 T	4.6 T
23	3.2 T	6.1	4.5 T	4.6 T	5.8
24	3.3 T	4.3 T	4.6 T	4.1 T	5.2
25	ND	4.4 T	4.3 T	4.4 T	4.6 T
26	4.2 T	5.5	5.2	5.0 T	5.4
27	3.3 T	3.3 T	4.7 T	3.8 T	5.2
28	3.4 T	130.0	4.2 T	45.9	6.0
29	3.7 T	4.8 T	4.2 T	4.2 T	5.2
30	3.4 T	4.0 T	4.3 T	3.9 T	5.1
31	3.2 T	ND	4.4 T	3.8 T	5.3
32	3.1 T	4.5 T	7.5	5.0	5.6
33	3.5 T	3.9 T	7.9	5.1	7.7
34	3.4 T	3.8 T	7.6	4.9 T	ND
35	3.9 T	ND	7.1	5.5	7.8
36	3.1 T	17.0	5.6	8.6	11.0
37	3.6 T	9.4	9.5	7.5	4.9 T
38	2.9 T	4.0 T	7.2	4.7 T	6.1
39	3.1 T	3.6 T	4.2 T	3.6 T	8.2
ULN	6	6	6		NG

NA - not analyzed
ND - no data
NG - no ULN guideline.

T - all results below 5.0 ug/g are considered trace amounts
< -less than the smallest measurable amount for this analytical method

Table 21: Results of Chemical Analysis for Nitrogen in Silver Maple Foliage and Mossbags in the Vicinity of Tricil Ltd. , Corruna in 1989 and 1990 (all results are in mg/g dry weight)

	Soil	Maple Foliage	
St. No.	1989	1989	1990
1	NA	24	21
2	NA	28	25
3	NA	23	26
4	NA	28	21
6	NA	23	23
8	NA	21	28
11	NA	23	21
13	NA	26	ND
15	NA	24	23
17	NA	24	24
20	NA	24	25
22	NA	21	19
23	NA	22	23
24	NA	21	17
27	NA	25	33
28	NA	16	19
29	NA	23	ND
30	NA	30	23
31	NA	26	21
32	NA	22	20
ULN	NG	NG	NG

	Moss Bags				
St. No.	Jun-89	Jul-89	Aug-89	Mean-89	Jun-Aug/90
1	NA	NA	NA	NA	11.0
2	NA	NA	NA	NA	8.1
3	NA	NA	NA	NA	9.7
4	NA	NA	NA	NA	6.0
5	NA	NA	NA	NA	9.6
6	NA	NA	NA	NA	ND
7	NA	NA	NA	NA	7.7
8	NA	NA	NA	NA	8.5
9	NA	NA	NA	NA	9.1
10	NA	NA	NA	NA	7.1
11	NA	NA	NA	NA	8.6
12	NA	NA	NA	NA	5.7
13	NA	NA	NA	NA	6.9
14	NA	NA	NA	NA	8.5
15	NA	NA	NA	NA	5.4
16	NA	NA	NA	NA	5.3
17	NA	NA	NA	NA	4.8
18	NA	NA	NA	NA	5.9
19	NA	NA	NA	NA	6.1
20	NA	NA	NA	NA	6.5
21	NA	NA	NA	NA	5.7
22	NA	NA	NA	NA	5.8
23	NA	NA	NA	NA	5.3
24	NA	NA	NA	NA	6.2
25	NA	NA	NA	NA	6.8
26	NA	NA	NA	NA	6.8
27	NA	NA	NA	NA	9.3
28	NA	NA	NA	NA	6.6
29	NA	NA	NA	NA	7.2
30	NA	NA	NA	NA	12.0
31	NA	NA	NA	NA	8.8
32	NA	NA	NA	NA	6.5
33	NA	NA	NA	NA	6.8
34	NA	NA	NA	NA	ND
35	NA	NA	NA	NA	7.3
36	NA	NA	NA	NA	7.9
37	NA	NA	NA	NA	6.9
38	NA	NA	NA	NA	4.9
39	NA	NA	NA	NA	3.7
ULN	NG	NG	NG		NG

ND - no data NA - not analyzed
NG - no ULN guideline.

Table 22: Results of Chemical Analysis for Phosphorus in Silver Maple Foliage in the Vicinity of Tricil Ltd. , Corruna in 1989 and 1990 (all results are in mg/g dry weight)

	Soil	Maple Foliage	
St. No.	1989	1989	1990
1	NA	1.9	1.7
2	NA	2.4	2.2
3	NA	1.8	2.3
4	NA	2.0	1.5
6	NA	2.6	2.5
8	NA	1.6	2.6
11	NA	1.5	1.8
13	NA	3.2	ND
15	NA	3.2	2.7
17	NA	3.0	1.9
20	NA	3.2	2.5
22	NA	2.0	1.8
23	NA	1.5	2.3
24	NA	1.8	2.3
27	NA	2.2	3.2
28	NA	1.4	1.9
29	NA	1.6	ND
30	NA	2.0	3.3
31	NA	3.7	3.2
32	NA	1.6	1.8
ULN	NG	NG	NG

	Moss Bags				
St. No.	Jun-89	Jul-89	Aug-89	Mean-89	Jun-Aug/90
1	NA	NA	NA	NA	NA
2	NA	NA	NA	NA	NA
3	NA	NA	NA	NA	NA
4	NA	NA	NA	NA	NA
5	NA	NA	NA	NA	NA
6	NA	NA	NA	NA	NA
7	NA	NA	NA	NA	NA
8	NA	NA	NA	NA	NA
9	NA	NA	NA	NA	NA
10	NA	NA	NA	NA	NA
11	NA	NA	NA	NA	NA
12	NA	NA	NA	NA	NA
13	NA	NA	NA	NA	NA
14	NA	NA	NA	NA	NA
15	NA	NA	NA	NA	NA
16	NA	NA	NA	NA	NA
17	NA	NA	NA	NA	NA
18	NA	NA	NA	NA	NA
19	NA	NA	NA	NA	NA
20	NA	NA	NA	NA	NA
21	NA	NA	NA	NA	NA
22	NA	NA	NA	NA	NA
23	NA	NA	NA	NA	NA
24	NA	NA	NA	NA	NA
25	NA	NA	NA	NA	NA
26	NA	NA	NA	NA	NA
27	NA	NA	NA	NA	NA
28	NA	NA	NA	NA	NA
29	NA	NA	NA	NA	NA
30	NA	NA	NA	NA	NA
31	NA	NA	NA	NA	NA
32	NA	NA	NA	NA	NA
33	NA	NA	NA	NA	NA
34	NA	NA	NA	NA	NA
35	NA	NA	NA	NA	NA
36	NA	NA	NA	NA	NA
37	NA	NA	NA	NA	NA
38	NA	NA	NA	NA	NA
39	NA	NA	NA	NA	NA
ULN	NG	NG	NG		NG

ND - no data NA - not analyzed
NG - no ULN guideline.

Table 23: Results of Chemical Analysis for Potassium inSilver Maple Foliage in the Vicinity of Tricil Ltd. , Corruna in 1989 and 1990 (all results are in % dry weight)

	Soil	Maple Foliage	
St. No.	1989	1989	1990
1	NA	0.90	0.95
2	NA	0.64	0.75
3	NA	0.79	0.95
4	NA	0.47	0.59
6	NA	0.96	0.66
8	NA	0.82	0.89
11	NA	1.00	1.03
13	NA	0.70	ND
15	NA	0.56	0.81
17	NA	0.62	0.69
20	NA	0.86	0.79
22	NA	0.90	0.84
23	NA	0.80	0.75
24	NA	0.88	0.83
27	NA	1.00	0.81
28	NA	0.82	0.91
29	NA	0.76	ND
30	NA	0.81	0.85
31	NA	0.72	0.81
32	NA	1.70	0.75
ULN	NG	NG	NG

	Moss Bags				
St. No.	Jun-89	Jul-89	Aug-89	Mean-89	Jun-Aug/90
1	NA	NA	NA	NA	NA
2	NA	NA	NA	NA	NA
3	NA	NA	NA	NA	NA
4	NA	NA	NA	NA	NA
5	NA	NA	NA	NA	NA
6	NA	NA	NA	NA	NA
7	NA	NA	NA	NA	NA
8	NA	NA	NA	NA	NA
9	NA	NA	NA	NA	NA
10	NA	NA	NA	NA	NA
11	NA	NA	NA	NA	NA
12	NA	NA	NA	NA	NA
13	NA	NA	NA	NA	NA
14	NA	NA	NA	NA	NA
15	NA	NA	NA	NA	NA
16	NA	NA	NA	NA	NA
17	NA	NA	NA	NA	NA
18	NA	NA	NA	NA	NA
19	NA	NA	NA	NA	NA
20	NA	NA	NA	NA	NA
21	NA	NA	NA	NA	NA
22	NA	NA	NA	NA	NA
23	NA	NA	NA	NA	NA
24	NA	NA	NA	NA	NA
25	NA	NA	NA	NA	NA
26	NA	NA	NA	NA	NA
27	NA	NA	NA	NA	NA
28	NA	NA	NA	NA	NA
29	NA	NA	NA	NA	NA
30	NA	NA	NA	NA	NA
31	NA	NA	NA	NA	NA
32	NA	NA	NA	NA	NA
33	NA	NA	NA	NA	NA
34	NA	NA	NA	NA	NA
35	NA	NA	NA	NA	NA
36	NA	NA	NA	NA	NA
37	NA	NA	NA	NA	NA
38	NA	NA	NA	NA	NA
39	NA	NA	NA	NA	NA
ULN	NG	NG	NG	NG	NG

ND - no data NA - not analyzed
NG - no ULN guideline.

Table 24 Results of Chemical Analysis for Selenium in Soil, Silver Maple Foliage and Mossbags in the Vicinity of Tricil Ltd. , Corruna in 1989 and 1990 (all results are in ug/g dry weight)

	Soil	Maple Foliage	
St. No.	1989	1989	1990
1	1.5 T	<0.2	<0.2
2	0.8 T	<0.2	<0.2
3	0.4 T	<0.2	<0.2
4	0.2 T	<0.2	<0.2
6	0.9 T	<0.2	<0.2
8	0.4 T	<0.2	<0.2
11	0.9 T	<0.2	<0.2
13	0.9 T	<0.2	ND
15	0.5 T	<0.2	<0.2
17	0.9 T	<0.2	<0.2
20	1.0 T	<0.2	<0.2
22	0.6 T	<0.2	<0.2
23	0.4 T	<0.2	<0.2
24	0.5 T	<0.2	<0.2
27	1.0 T	0.5 T	<0.2
28	0.9 T	<0.2	<0.2
29	0.8 T	<0.2	ND
30	0.4 T	<0.2	<0.2
31	0.5 T	<0.2	<0.2
32	1.0 T	<0.2	<0.2
ULN	2	0.5	0.5

	Moss Bags				
St. No.	Jun-89	Jul-89	Aug-89	Mean-89	Jun-Aug/90
1	0.31 T	0.66 T	0.40 T	0.46 T	0.81 T
2	0.44 T	0.59 T	0.46 T	0.50 T	0.98 T
3	0.34 T	0.55 T	0.32 T	0.40 T	0.80 T
4	0.36 T	0.59 T	0.37 T	0.44 T	0.86 T
5	0.35 T	0.67 T	0.39 T	0.47 T	0.89 T
6	0.39 T	0.55 T	0.48 T	0.47 T	ND
7	0.31 T	0.59 T	0.47 T	0.46 T	1.10 T
8	0.43 T	0.60 T	0.46 T	0.50 T	1.40 T
9	0.31 T	0.53 T	0.45 T	0.43 T	1.10 T
10	0.31 T	0.68 T	0.41 T	0.47 T	0.82 T
11	0.31 T	0.67 T	0.37 T	0.45 T	0.99 T
12	0.38 T	0.50 T	0.42 T	0.43 T	0.81 T
13	0.41 T	0.67 T	0.38 T	0.49 T	0.89 T
14	0.51 T	0.75 T	0.41 T	0.56 T	1.10 T
15	0.39 T	0.67 T	0.38 T	0.48 T	0.81 T
16	0.42 T	0.60 T	0.46 T	0.49 T	0.81 T
17	ND	0.44 T	ND	0.44 T	0.79 T
18	0.41 T	0.47 T	0.47 T	0.45 T	1.10 T
19	0.37 T	0.50 T	0.39 T	0.42 T	0.51 T
20	0.40 T	0.40 T	0.51 T	0.44 T	0.10 T
21	0.37 T	0.46 T	0.43 T	0.42 T	0.10 T
22	0.38 T	0.34 T	0.53 T	0.42 T	0.50 T
23	0.37 T	0.51 T	0.43 T	0.44 T	0.93 T
24	0.34 T	0.38 T	0.49 T	0.40 T	0.65 T
25	ND	0.43 T	0.42 T	0.43 T	0.65 T
26	0.37 T	0.41 T	0.42 T	0.40 T	0.63 T
27	0.37 T	0.48 T	0.49 T	0.45 T	0.80 T
28	0.45 T	0.40 T	0.49 T	0.45 T	0.49 T
29	0.38 T	0.50 T	0.46 T	0.45 T	0.10 T
30	0.35 T	0.31 T	0.39 T	0.35 T	0.10 T
31	0.36 T	0.37 T	0.43 T	0.39 T	0.77 T
32	0.31 T	0.48 T	0.46 T	0.42 T	0.76 T
33	0.61 T	0.42 T	0.50 T	0.51 T	0.90 T
34	0.60 T	0.41 T	0.49 T	0.50 T	ND
35	0.68 T	ND	0.41 T	0.55 T	0.78 T
36	0.52 T	0.33 T	0.41 T	0.42 T	0.77 T
37	0.48 T	0.46 T	0.48 T	0.47 T	0.63 T
38	0.51 T	0.42 T	0.38 T	0.44 T	0.76 T
39	0.53 T	0.41 T	0.47 T	0.47 T	0.47 T
ULN	0.6	0.6	0.6		NG

NA - not analyzed
ND - no data
NG - no ULN guideline.

T - all results below 2.0 ug/g are considered trace amounts
< -less than the smallest measurable amount for this analytical method

Table 25 Results of Chemical Analysis for Sodium in Soil, Silver Maple Foliage and Mossbags in the Vicinity of Tricil Ltd. , Corruna in 1989 and 1990 (all results are in ug/g dry weight)

	Soil	Maple Foliage	
St. No.	1989	1989	1990
1	130	23	24
2	120	13 T	12 T
3	130	10 T	56
4	160	11 T	18 T
6	99	10 T	19 T
8	62	112	21
11	98	18 T	21
13	94	24	ND
15	100	28	37
17	89	12 T	17 T
20	80	18 T	17 T
22	80	22	17 T
23	85	32	19 T
24	140	22	26
27	81	10 T	13 T
28	72	23	23
29	92	20	ND
30	53	17 T	21
31	120	17 T	22
32	98	44	18 T
ULN	NG	50	50

	Moss Bags				
St. No.	Jun-89	Jul-89	Aug-89	Mean-89	Jun-Aug/90
1	59	150	230	146	49
2	180	200	220	200	130
3	37	140	250	142	65
4	110	94	170	125	49
5	750	200	210	387	48
6	74	110	98	94	ND
7	81	91	310	161	280
8	45	160	120	108	44
9	36	120	160	105	58
10	26	58	210	98	39
11	85	100	180	122	54
12	66	93	140	100	50
13	140	200	330	223	47
14	160	170	210	180	72
15	300	190	190	227	80
16	77	99	440	205	42
17	ND	140	ND	140	42
18	150	140	180	157	70
19	120	210	730	353	73
20	150	74	200	141	44
21	47	140	140	109	28
22	35	130	180	115	36
23	39	120	180	113	66
24	21	56	220	99	58
25	ND	140	270	205	44
26	120	150	270	180	180
27	330	230	270	277	86
28	280	150	470	300	56
29	40	170	240	150	52
30	200	120	180	167	44
31	92	ND	240	166	91
32	45	190	250	162	53
33	34	160	290	161	54
34	54	110	210	125	ND
35	200	ND	120	160	130
36	65	100	140	102	65
37	62	250	160	157	94
38	87	270	170	176	30
39	200	140	220	187	92
ULN	NG	NG	NG		NG

NA - not analyzed
ND - no data
NG - no ULN guideline.

T - all results below 20 ug/g are considered trace amounts
< -less than the smallest measurable amount for this analytical method

Table 26: Results of Chemical Analysis for Strontium in Soil, Silver Maple Foliage and Mossbags in the Vicinity of Tricil Ltd. , Corruna in 1989 and 1990 (all results are in ug/g dry weight)

	Soil	Maple Foliage	
St. No.	1989	1989	1990
1	55	180	41
2	61	30	27
3	54	26	115
4	70	44	47
6	50	22	27
8	22	18	59
11	40	30	30
13	23	28	ND
15	28	37	34
17	36	25	42
20	25	24	35
22	74	16	29
23	26	26	46
24	25	30	35
27	30	26	39
28	26	22	29
29	29	18	ND
30	18	20	31
31	54	20	30
32	31	25	17
ULN	NG	NG	NG

	Moss Bags				
St. No.	Jun-89	Jul-89	Aug-89	Mean-89	Jun-Aug/90
1	20	17	15	17	15
2	19	15	16	17	15
3	15	16	14	15	13
4	16	16	15	16	16
5	35	21	24	27	16
6	20	16	18	18	ND
7	15	15	17	16	25
8	17	16	19	17	21
9	19	16	17	17	24
10	15	16	15	15	17
11	14	17	19	17	23
12	20	17	22	20	32
13	21	18	19	19	22
14	19	18	16	18	25
15	21	23	17	20	26
16	17	11	19	16	15
17	ND	14	ND	14	17
18	21	10	17	16	17
19	17	12	22	17	19
20	19	10	16	15	19
21	20	10	15	15	14
22	16	10	17	14	15
23	19	14	21	18	20
24	16	10	17	14	12
25	ND	10	16	13	17
26	17	14	19	17	21
27	19	11	18	16	15
28	21	16	19	19	22
29	18	13	18	16	16
30	17	11	15	14	13
31	22	ND	18	20	16
32	18	12	16	15	16
33	19	11	19	16	17
34	16	11	19	15	ND
35	21	ND	22	22	30
36	16	31	23	23	20
37	27	11	15	18	14
38	17	19	24	20	14
39	14	12	16	14	35
ULN	NG	NG	NG		NG

ND - no data NA - not analyzed
NG - no ULN guideline.

Table 27: Results of Chemical Analysis for Sulphur in Silver Maple Foliage and Mossbags in the Vicinity of Tricil Ltd. , Corruna in 1989 and 1990 (all results are in % dry weight)

	Soil	Maple Foliage	
St. No.	1989	1989	1990
1	NA	0.13	0.13
2	NA	0.16	0.17
3	NA	0.16	0.17
4	NA	0.14	0.15
6	NA	0.17	0.15
8	NA	0.12	0.17
11	NA	0.17	0.17
13	NA	0.16	ND
15	NA	0.15	0.17
17	NA	0.14	0.13
20	NA	0.16	0.16
22	NA	0.13	0.13
23	NA	0.16	0.18
24	NA	0.16	0.15
27	NA	0.17	0.23
28	NA	0.14	0.13
29	NA	0.19	ND
30	NA	0.18	0.16
31	NA	0.12	0.14
32	NA	0.13	0.16
ULN	0.1	0.4	0.4

	Moss Bags				
St. No.	Jun-89	Jul-89	Aug-89	Mean-89	Jun-Aug/90
1	NA	NA	NA	NA	0.11
2	NA	NA	NA	NA	0.12
3	NA	NA	NA	NA	0.10
4	NA	NA	NA	NA	0.09
5	NA	NA	NA	NA	0.14
6	NA	NA	NA	NA	ND
7	NA	NA	NA	NA	0.33
8	NA	NA	NA	NA	0.13
9	NA	NA	NA	NA	0.21
10	NA	NA	NA	NA	0.09
11	NA	NA	NA	NA	0.18
12	NA	NA	NA	NA	0.20
13	NA	NA	NA	NA	0.23
14	NA	NA	NA	NA	0.21
15	NA	NA	NA	NA	0.18
16	NA	NA	NA	NA	0.10
17	NA	NA	NA	NA	0.09
18	NA	NA	NA	NA	0.13
19	NA	NA	NA	NA	0.13
20	NA	NA	NA	NA	0.10
21	NA	NA	NA	NA	0.08
22	NA	NA	NA	NA	0.09
23	NA	NA	NA	NA	0.16
24	NA	NA	NA	NA	0.10
25	NA	NA	NA	NA	0.10
26	NA	NA	NA	NA	0.10
27	NA	NA	NA	NA	0.12
28	NA	NA	NA	NA	0.14
29	NA	NA	NA	NA	0.11
30	NA	NA	NA	NA	0.11
31	NA	NA	NA	NA	0.16
32	NA	NA	NA	NA	0.12
33	NA	NA	NA	NA	0.10
34	NA	NA	NA	NA	ND
35	NA	NA	NA	NA	0.26
36	NA	NA	NA	NA	0.16
37	NA	NA	NA	NA	0.11
38	NA	NA	NA	NA	0.08
39	NA	NA	NA	NA	0.15
ULN	0.1	0.1	0.1		NG

ND - no data NA - not analyzed
NG - no ULN guideline.

Table 28 Results of Chemical Analysis for Vanadium in Soil, Silver Maple Foliage and Mossbags in the Vicinity of Tricil Ltd. , Corruna in 1989 and 1990 (all results are in ug/g dry weight)

	Soil	Maple Foliage	
St. No.	1989	1989	1990
1	43	<0.5	<0.5
2	34	<0.5	0.6 T
3	39	<0.5	0.8 T
4	39	<0.5	0.5 T
6	36	<0.5	0.7 T
8	22	<0.5	0.7 T
11	36	<0.5	0.9 T
13	42	<0.5	ND
15	31	<0.5	0.9 T
17	46	<0.5	0.7 T
20	42	<0.5	0.7 T
22	36	<0.5	0.6 T
23	34	0.7 T	0.6 T
24	33	<0.5	0.8 T
27	46	<0.5	0.6 T
28	38	0.9 T	0.9 T
29	35	<0.5	ND
30	28	<0.5	0.7 T
31	22	<0.5	0.8 T
32	26	<0.5	0.7 T
ULN	70	5	5

	Moss Bags				
St. No.	Jun-89	Jul-89	Aug-89	Mean-89	Jun-Aug/90
1	4.7 T	6.3	6.4	5.8	7
2	5.1	5.5	7.3	6.0	7
3	4.5 T	6.2	6.3	5.7	5.8
4	5.5	5.3	6.4	5.7	5.9
5	5.1	6.6	7.8	6.5	8.6
6	4.7 T	5.9	6.8	5.8	ND
7	5.4	7.0	6.6	6.3	7.3
8	5.2	5.8	7.4	6.1	6
9	5.2	6.1	6.8	6.0	7.5
10	4.7 T	6.8	7.3	6.3	6.9
11	4.6 T	7.1	6.7	6.1	3.4 T
12	5.1	7.3	7.4	6.6	5.9
13	6.0	8.2	10.0	8.1	8
14	5.1	6.7	7.3	6.4	5
15	5.3	7.2	8.0	6.8	7.3
16	5.9	6.3	7.1	6.4	8.1
17	ND	6.9	ND	6.9	7.6
18	5.5	5.8	6.9	6.1	7.2
19	5.1	7.3	7.5	6.6	7.3
20	5.2	8.3	8.0	7.2	7.4
21	5.3	6.5	7.1	6.3	6.8
22	5.3	5.8	7.7	6.3	6.9
23	5.7	6.8	7.0	6.5	8
24	5.7	6.0	7.1	6.3	6.9
25	ND	8.1	7.2	7.7	7.4
26	5.8	6.6	6.3	6.2	6.8
27	5.9	6.4	8.1	6.8	6.8
28	6.1	7.7	6.7	6.8	6.4
29	6.8	7.5	7.0	7.1	6.9
30	5.4	6.5	6.7	6.2	3.2 T
31	5.2	ND	6.7	6.0	3.2 T
32	5.5	6.9	8.0	6.8	5.9
33	5.6	6.7	8.1	6.8	8.3
34	5.9	6.2	7.4	6.5	ND
35	5.7	ND	5.5	5.6	3.2 T
36	4.9 T	20.0	7.6	10.8	6.9
37	4.4 T	6.8	7.0	6.1	5.3
38	4.7 T	6.4	5.6	5.6	7.2
39	6.1	6.0	5.9	6.0	4.4 T
ULN	NG	NG	NG		NG

NA - not analyzed
ND - no data
NG - no ULN guideline.

T - all results below 5.0 ug/g are considered trace amounts
< -less than the smallest measurable amount for this analytical method

Table 29: Results of Chemical Analysis for Zinc in Soil, Silver Maple Foliage and Mossbags in the Vicinity of Tricil Ltd. , Corruna in 1989 and 1990 (all results are in ug/g dry weight)

	Soil	Maple Foliage		Moss Bags				
St. No.	1989	1989	1990	St. No.	Jun-89	Jul-89	Aug-89	Mean-89	Jun-Aug/90
1	110	25	24	1	59	56	53	56	67
2	130	24	21	2	55	49	59	54	58
3	68	18	40	3	68	57	54	60	81
4	53	28	31	4	54	42	52	49	59
6	88	21	34	5	80	48	60	63	150
8	70	22	32	6	56	60	59	58	ND
11	78	20	26	7	100	110	64	91	65
13	88	37	ND	8	50	57	60	56	110
15	180	39	40	9	87	68	70	75	120
17	96	31	35	10	52	49	58	53	140
20	83	16	24	11	74	140	88	101	110
22	87	23	31	12	49	48	56	51	63
23	56	24	36	13	54	59	56	56	110
24	57	42	32	14	68	56	62	62	110
27	84	26	32	15	58	100	63	74	150
28	69	30	40	16	64	46	63	58	60
29	74	28	ND	17	ND	71	ND	71	68
30	56	30	38	18	85	65	84	78	120
31	63	32	34	19	49	49	54	51	55
32	55	18	19	20	57	51	66	58	77
ULN	500	250	250	21	61	68	70	66	76
				22	62	56	64	61	82
				23	62	47	59	56	64
				24	65	67	94	75	99
				25	ND	68	75	72	97
				26	91	180	76	116	150
				27	56	47	60	54	69
				28	57	68	77	67	79
				29	84	83	73	80	87
				30	62	64	83	70	170
				31	54	ND	62	58	100
				32	65	65	62	64	91
				33	71	54	63	63	91
				34	78	51	65	65	ND
				35	66	ND	76	71	63
				36	53	49	55	52	96
				37	55	68	64	62	73
				38	64	42	51	52	91
				39	48	59	68	58	43
				ULN	100	100	100		NG

ND - no data NA - not analyzed
NG - no ULN guideline.

Section 4: Discussion

Due to the large amount of data, the discussion has been formatted by individual element. Each subsection contains the discussion of the soil, vegetation and mossbag results for 1989 and 1990.

Concentration contour maps were produced using the graphics program "Surfer version 4.0". The contour maps were only produced when there was a difference between the minimum and maximum values, for a given receptor, of greater than twice the minimum value. These maps are only statistical approximations of the spatial distribution of the different contaminants. The maps are only to be used to provide information on the approximate areas and/or patterns of contamination. They can not be used to determine the actual concentration of a contaminant at a location where samples were not taken.

The contours produced by the program are significantly affected by the spatial distribution of the sampling sites, the accuracy of the positional information of the sampling sites, and the program options used to generate the contours. The accuracy of the contours deteriorates at the edges of the map and in large areas where there are no sampling sites. Therefore, contours near the edge of the map should be interpreted with caution. Large areas without sampling sites were blocked out so no contours could be drawn through them.

The program options used in generating the contours remained constant for each map. The options used for the maps in this report were:

Grid Interpolation Method	:	Kriging
Search Method	:	Normal
Search Radius	:	Full Width of Map
No. of Nearest Points	:	10
Grid Size	:	26 x 20
Contour (in line) Smoothing	:	Yes
Tension Factor	:	2

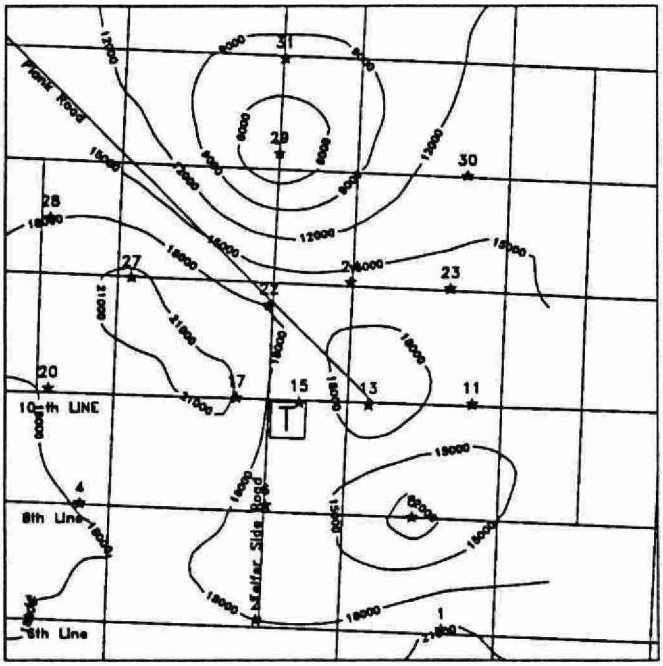
The contour interval, minimum contour and maximum contour for each map are given at the bottom of each map. The units of measurement for the contours are the same as in the tables. The location of the sampling sites are indicated by a star with the sample site number immediately above, the approximate locations of major features such as roads are shown and the approximate location of Tricil is shown by a box with an capital T in the middle.

The prevailing winds during the non-winter months are from the west south-west, therefore emissions from the Tricil stack and landfill operations would precipitate predominantly to the east north-east.

4.1 Aluminum

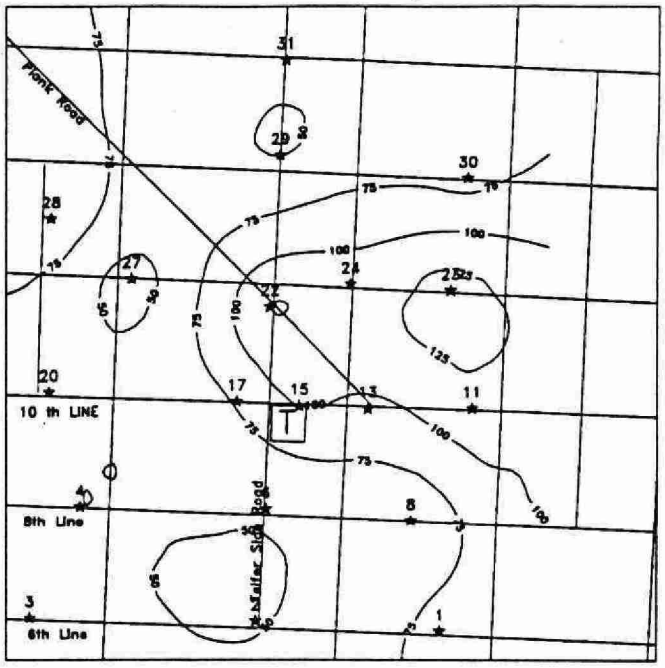
With the exception of the moss bag at Station 36 for July 1989, there were no exceedences of the ULN for aluminum in soil, silver maple foliage or moss bags for 1989 and 1990 (see Table 1). As aluminum is a major constituent of soil, in particular clays, it was not surprising that there was no pattern of aluminum in soil around the Tricil operation. There is a pattern of slightly elevated aluminum in silver maple around Tricil for both 1989 (Figure 4.1b) and 1990 (Figure 4.1c). In 1989, the area of elevated aluminum is to the north and east of the Tricil operation with the highest level occurring at Station 23. In 1990, the elevated levels also ran north and east of Tricil but are centered on Station 15, located on the northern boundary of Tricil. If these marginally elevated levels of aluminum in silver maple foliage are due to the Tricil operation, they probably came from dust generated from the land fill operation. Contour maps were not produced for the 1989 and 1990 moss bag data.

Figure 4.1a:
Pattern of Aluminum in Soil, 0-5 cm, in 1989.



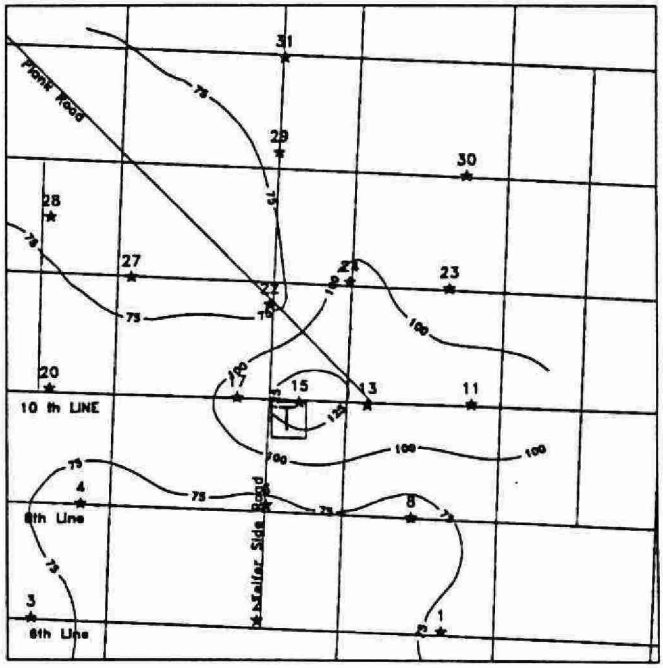
Contour Interval:3000 Min:3000 Max:21000 µg/g

Figure 4.1b:
Pattern of Aluminum in Silver Maple Foliage in 1989.



Contour Interval:25 Min:50 Max:125 µg/g

Figure 4.1c:
Pattern of Aluminum in Silver Maple Foliage in 1990.

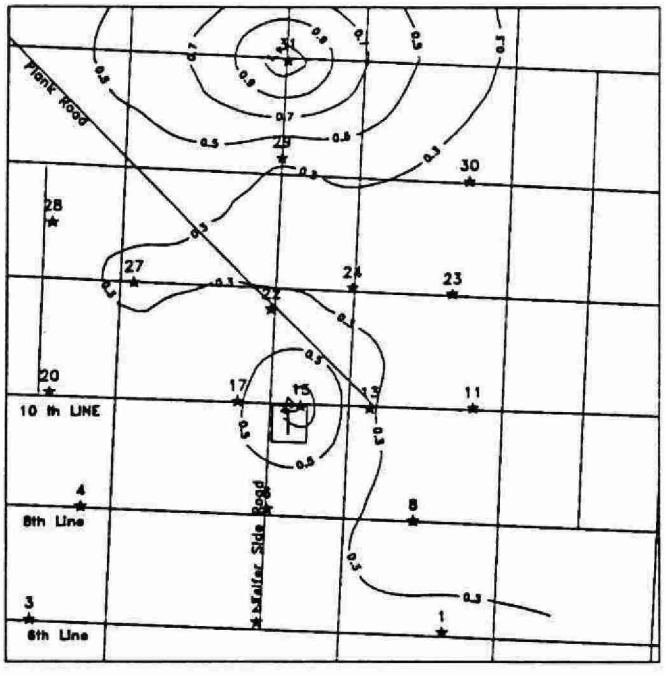


Contour Interval:40 Min:60 Max:140 µg/g

4.2 Antimony

Antimony concentrations exceeded the ULN for soil at Station 31, and Stations 4,6 and 8 for silver maple foliage for 1989. There is no ULN for antimony in moss bags. All of the antimony concentrations for all three receptors were "trace" or "less than" values, even those that exceed the ULN (see Table 2). With the exception of the soil (Figure 4.2a), there was insufficient range in the data to produce contour maps. Even in the soil map, it can be seen that what contours exist are produced by the results from two widely separated stations (15 and 31). In general, the concentrations of antimony in soil, maple foliage and mossbags were low and there was no pattern of antimony accumulation that could be attributed to the Tricil operation.

Figure 4.2a:
Pattern of Antimony in Soil, 0-5 cm, in 1989.



Contour Interval:0.2 Min:0.3 Max:1.1 µg/g

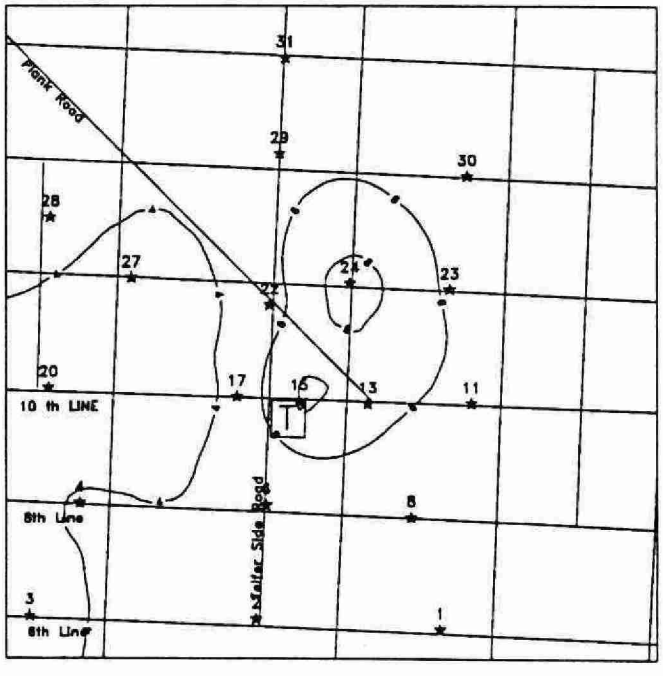
4.3 Arsenic

All of the soil arsenic concentrations were below the ULN, and there was insufficient range in the data to produce a contour map (see Table 3). All of the arsenic silver maple concentrations were less than 0.02 µg/g in 1989 and 1990. There were a large number of exceedences of the ULN for arsenic in moss bags in 1989. However, with the exception of Station 36 in July and Station 17 in August, all of the ULN exceedences were marginal and were considered to be trace amounts or tentative estimates. These exceedences were not considered significant. The elevated concentrations at Stations 17 and 36 were isolated incidents and were not repeated in the other months for 1989 or in longer duration exposures in 1990. Excluding these two stations, there was insufficient range in the data to produce contour maps for the 1989 and 1990 moss bag results. In general, the arsenic concentrations in soil, maple foliage and moss bags were low and there was no pattern of arsenic accumulation that can be attributed to the Tricil operation.

4.4 Barium

The 1989 soil samples were not anaylzed for barium. There was a pattern of marginially elevated barium in silver maple foliage around the Tricil operation in both 1989 (Figure 4.4a) and 1990 (Figure 4.4b). This elevated region extended from Tricil in a north-east direction as far as Station 30. It included Stations 13, 15 and 24 in both years and also Station 30 in 1990.

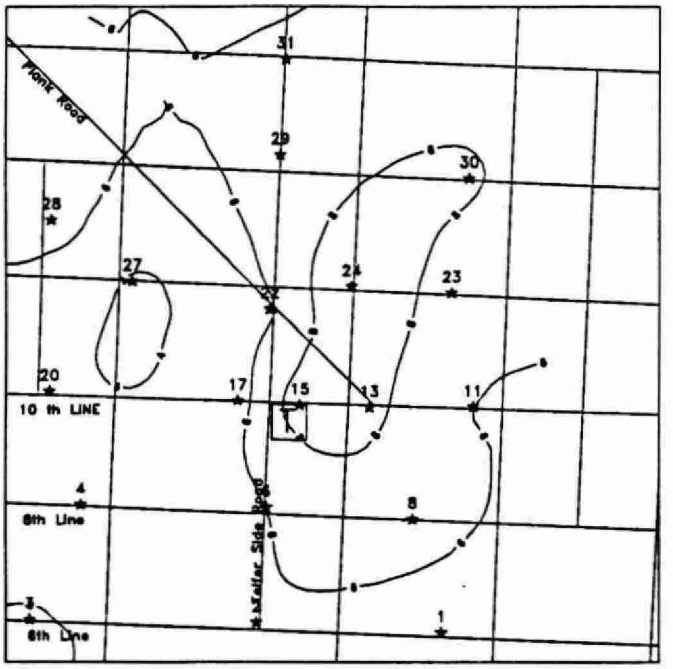
Figure 4.4a:
Pattern of Barium in Silver Maple Foliage in 1989.



Contour Interval:2 Min:4 Max:8 µg/g

There was insufficient range in the moss bag data to produce contour maps (see Table 4). The pattern of marginally elevated levels of barium in the silver maple foliage down wind of the Tricil operation was not observed in the moss bags. This may be due to the significantly higher background levels of barium that occur in the moss bags, thereby potentially masking marginally elevated levels.

Figure 4.4b:
Pattern of Barium in Silver Maple Foliage in 1990.

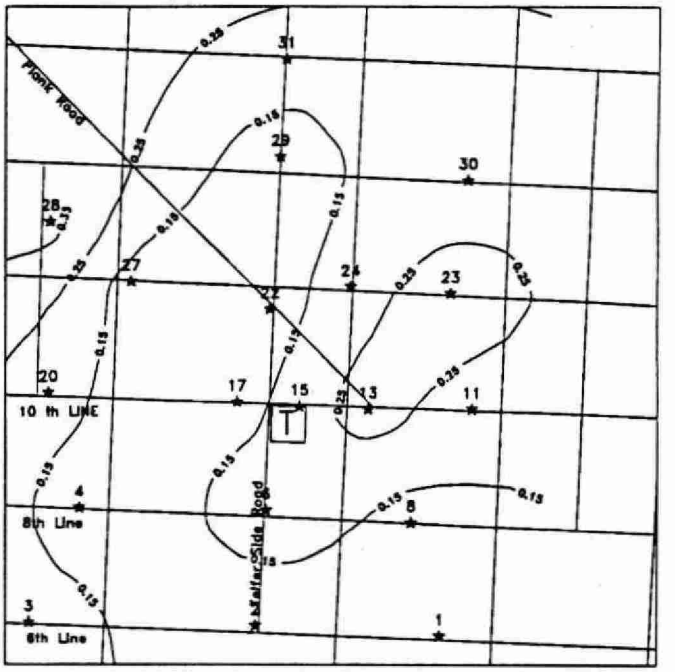


Contour Interval:2 Min:4 Max:8 µg/g

4.5 Beryllium

The 1989 soil samples were not analyzed for beryllium. All of the silver maple foliar data were low (see Table 5). Only the 1989 data had a large enough range for contour mapping but there was no pattern that could be related to Tricil (Figure 4.5). The moss bag concentrations for both 1989 and 1990 were also low, with insufficient range to produce contour maps. There was no evidence of beryllium accumulation in maple foliage or moss bags in 1989 or 1990 in the vicinity of Tricil.

Figure 4.5:
Pattern of Beryllium in Silver Maple Foliage in 1989.

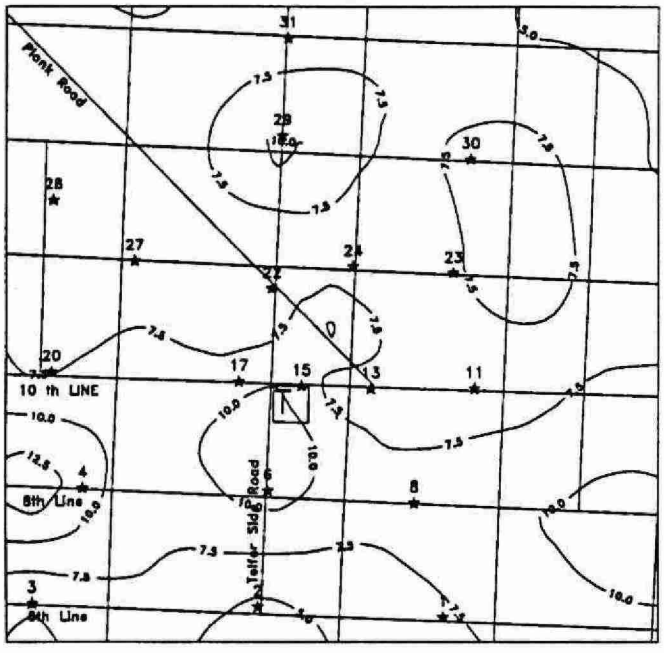


Contour Interval:0.1 Minimum:0.15 Maximum:0.35 µg/g

4.6 Boron

The 1990 surey samples were not analyzed for boron. All of the silver maple foliage concentrations were below the boron ULN and there was insufficient range in the data for contour mapping (see Table 6). The boron concentrations in the moss bags were also low. There was no pattern of accumulation of boron in the moss bags that could be related to Tricil (Figure 4.6).

Figure 4.6:
Pattern of Boron in Moss Bags in 1990.

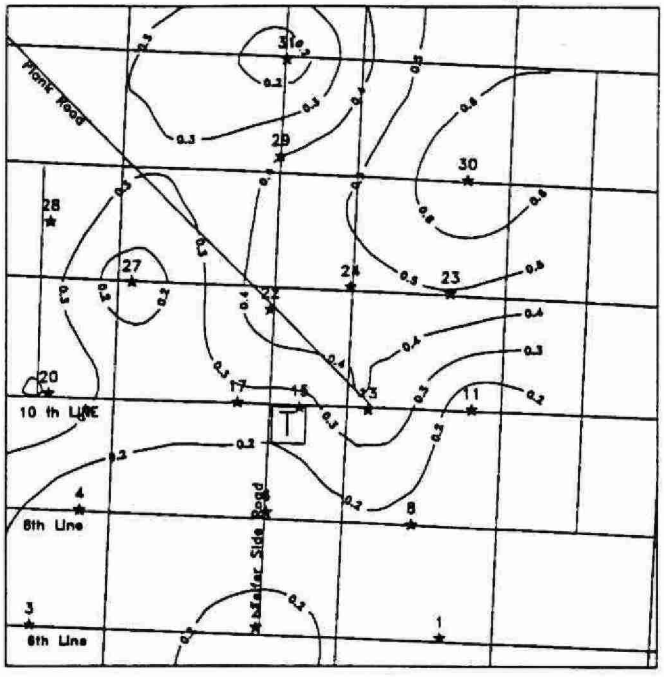


Contour Interval:2.5 Min:5.0 Max:12.5 µg/g

4.7 Cadmium

The cadmium concentrations in soil, silver maple foliage and moss bags were low in 1989 and 1990 (see Table 7). There were no exceedences of the cadmium ULN. With the exception of the 1989 silver maple foliage results, there was insufficient range in the data to produce contour maps. The 1989 silver maple data showed a pattern of marginally elevated cadmium levels northeast of Tricil and a second area of slightly elevated concentrations to the northwest near Sarnia (Figure 4.7). While the 1990 silver maple concentrations were lower than in 1989, the highest values in 1990 corresponded to the highest in 1989. All of the moss bag data for 1989 and 1990 were trace concentrations, and there was insufficient range in the data to produce contour maps.

Figure 4.7:
Pattern of Cadmium in Silver Maple Foliage in 1989.

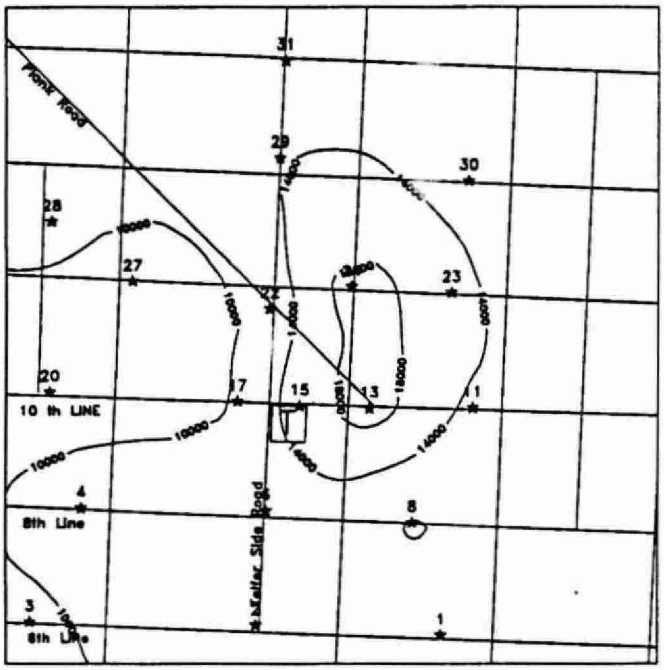


Contour Interval:0.1 Min:0.2 Max:0.6 µg/g

4.8 Calcium

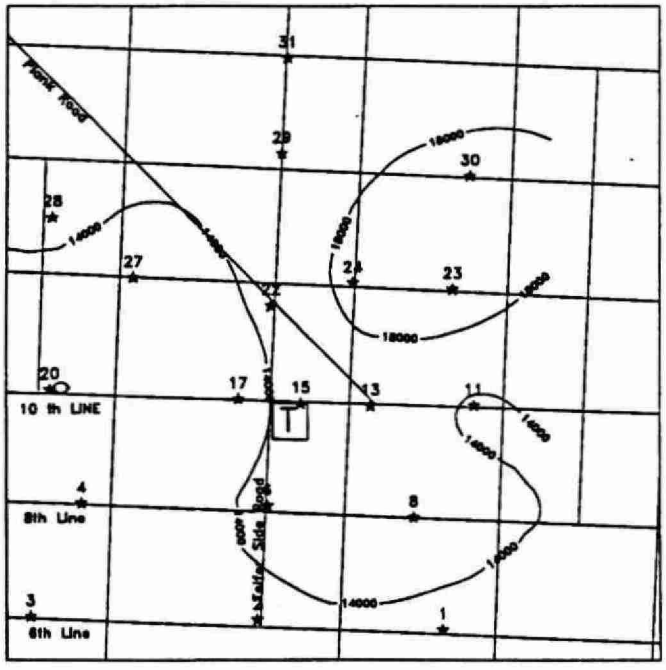
As calcium is present in very high concentrations in the clay soils in Lambton County, calcium analysis was not conducted on the soil samples. The calcium concentrations in silver maple foliage were moderatly elevated, but there were no exceedences of the ULN (see Table 8). There was a pattern of marginally elevated calcium in silver maple foliage around the Tricil operation in 1989 (Figure 4.8a). This pattern was less distinct in 1990 (Figure 4.8b). In general, the range of calcium concentrations in moss bags was slightly larger than the silver maple results. There was a pattern of marginally elevated calcium in moss bags for 1989 and 1990 around Tricil (Figure 4.8c and d). However, this pattern does not coincide with the silver maple results. If the elevated calcium concentrations are related to the Tricil operation, as in the case of aluminum, they are probably from dust generated by the landfill operations.

Figure 4.8a:
Pattern of Calcium in Silver Maple Foliage in 1989.



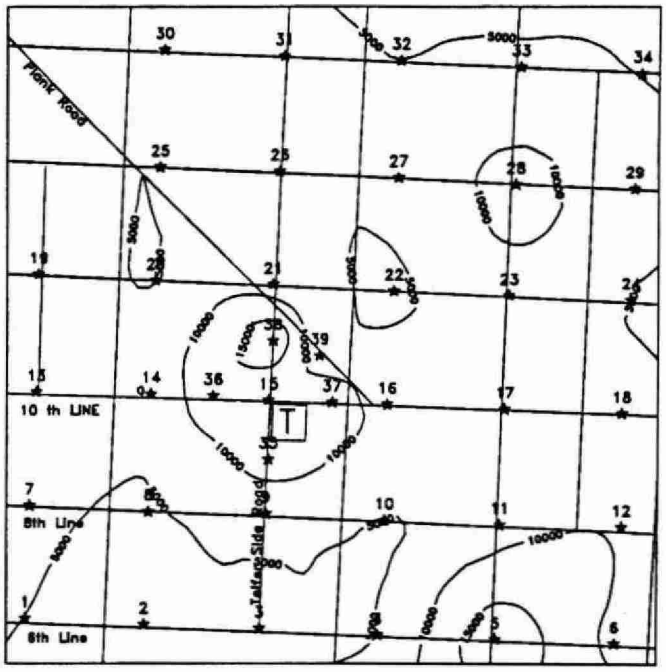
Contour Interval:4000 Min:10000 Max:18000 µg/g

Figure 4.8b:
Pattern of Calcium in Silver Maple Foliage in 1990.



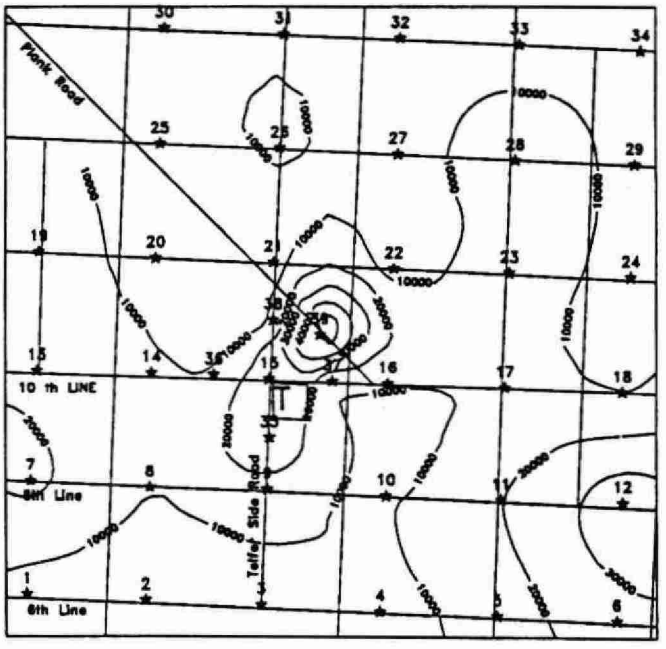
Contour Interval:4000 Min:10000 Max:18000 µg/g

Figure 4.8c:
Average Pattern of Calcium in Moss Bags in 1989.



Contour Interval:5000 Min:5000 Max:20000 µg/g

Figure 4.8d:
Pattern of Calcium in Moss Bags (3 month exposure) in 1990.



Contour Interval:10000 Min:10000 Max:70000 µg/g

4.9 Chloride

Chloride is of concern as it has been found to be a major constituent of emissions from waste incinerators. However, there is a potential problem with detecting accumulations of chloride in soil and vegetation around Tricil due to the naturally occurring salt deposits in Lambton county. The moss bag portion of this survey was originally added to try to differentiate between chloride in the soil that accumulated in silver maple foliage, and chloride that may be coming from Tricil.

The moderate range in the surface soil chloride concentrations (see Table 9) created a very distinct pattern of chloride levels in the surface soil, but it could not be related to the Tricil operation (Figure 4.9a). There was a large area of low chloride to the west of Tricil and another area of low soil chloride to the north and north east of the company. There was also an narrow area of high chloride running north south through the Tricil property from Station 2 to 29 and a second area of higher chloride to the east around Station 11.

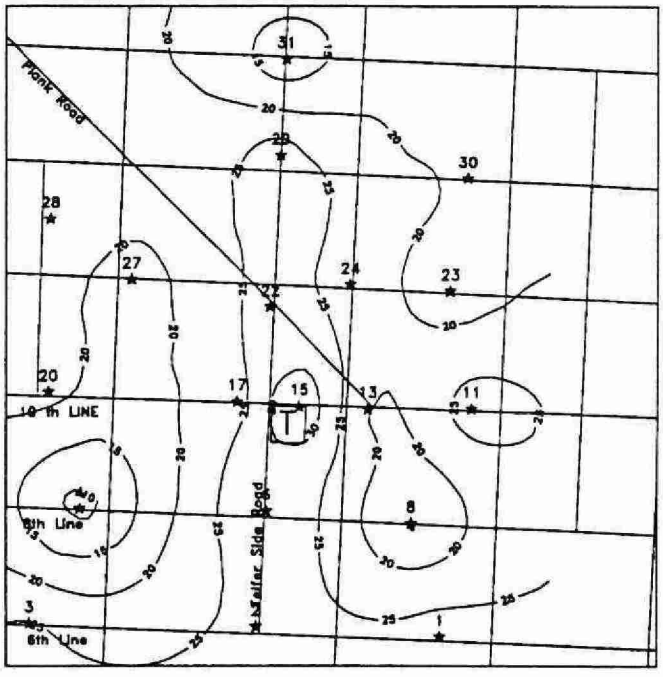
The levels of chloride in the silver maple had a larger range than the soil and 60% percent of the concentrations exceeded the chloride ULN for vegetation. This is similar to vegetation data from previous years, and is similar to what has been observed around other companies in Lambton county as the result of other Phytotoxicology surveys. Exceedences of the chloride ULN for foliage is not uncommon in Lambton county. The pattern of chloride in silver maple foliage was consistent in both years and, while not identical, was similar to the distribution of chloride in the surface soil. There were low areas of chloride to the west, north and northeast in the same areas as the soil. There was also an area of elevated chloride to the east around Station 11 as in the soil results. The narrow band of elevated chloride that ran north-south through Tricil in the soil was not observed in the silver maple foliage. There was also an area of high chloride in silver maple to the northwest of Tricil near Sarnia that was not apparent in the soil data.

There was insufficient material from the 1989 moss bags to perform the chloride analysis. In 1990, two moss bags were used at each location to ensure sufficient material for chloride analysis. With the exception of a high chloride result at Station 7, the 1990 moss bags had only moderate chloride concentrations. The pattern of chloride in moss bags was totally different from the soil and vegetation results, but there was no relationship with the Tricil operation. The Station 7 result was not used for the contour maps as it significantly significantly interfered with the contour pattern (Figure 4.9d).

While the chloride levels were high in the silver maple folaige at 60% of the sites in the vicinity of Tricil, the distribution was not related to the company. There is a fairly good relationship between the surface soil and silver maple foliage results. The fact that the pattern of chloride in moss bags was totally different from soil and maple, suggest that air borne chloride is not the source of high chloride levels in maple foliage. Localized pockets of elevated chloride in soil are the most likely cause of elevated chloride in maple foliage.

Figure 4.9a:

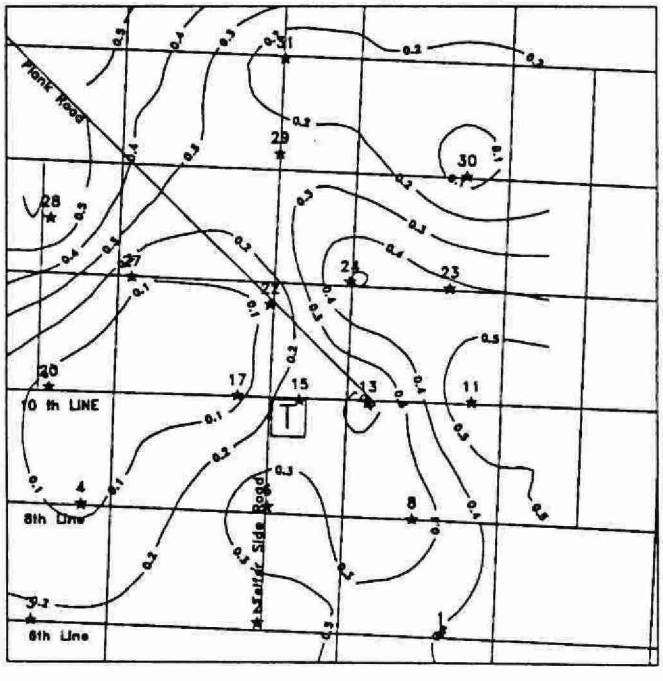
Pattern of Chloride in Soil, 0-5 cm, in 1989.



Contour Interval:5 Min:10 Max:30 µg/g

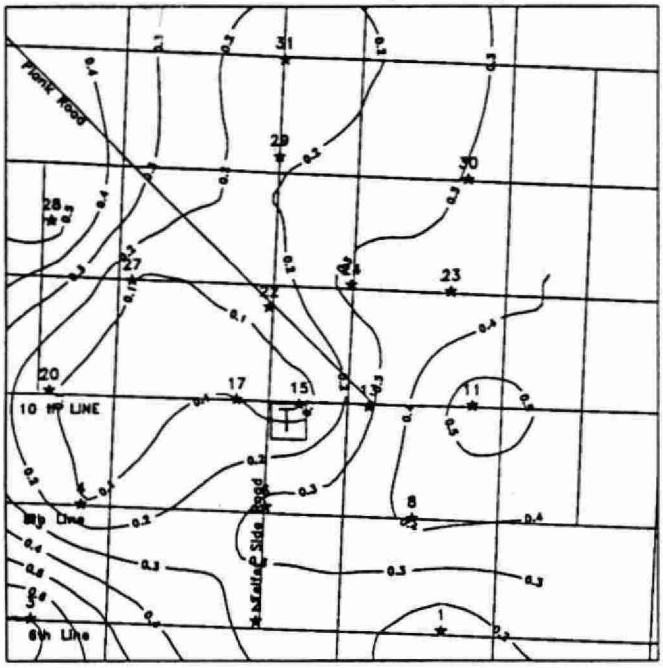
Figure 4.9b:

Pattern of Chloride in Silver Maple Foliage in 1989.



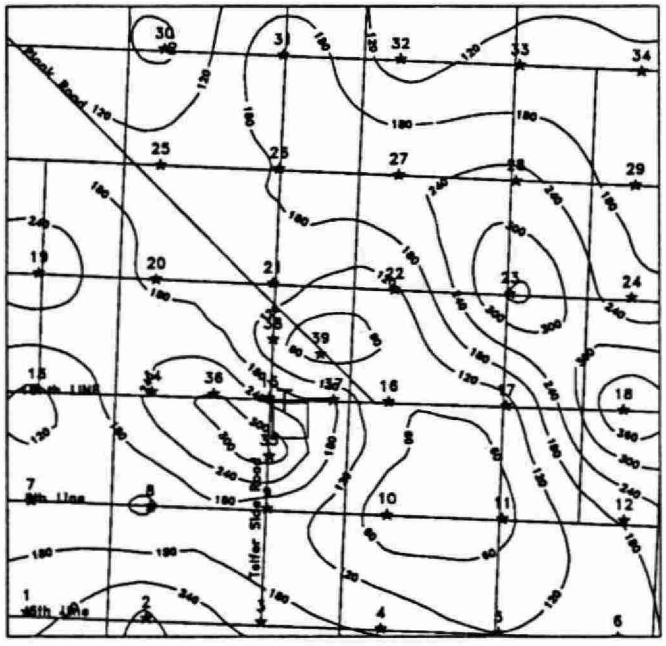
Contour Interval:0.1 Min:0.1 Max:0.7 %

Figure 4.9c:
Pattern of Chloride in Silver Maple Foliage in 1990.



Contour Interval:0.1 Min:0.1 Max:0.7 %

Figure 4.9d:
Pattern of Chloride in Moss Bags (3 month exposure) in 1990.



Contour Interval:60 Min:60 Max:360 µg/g

4.10 Chromium

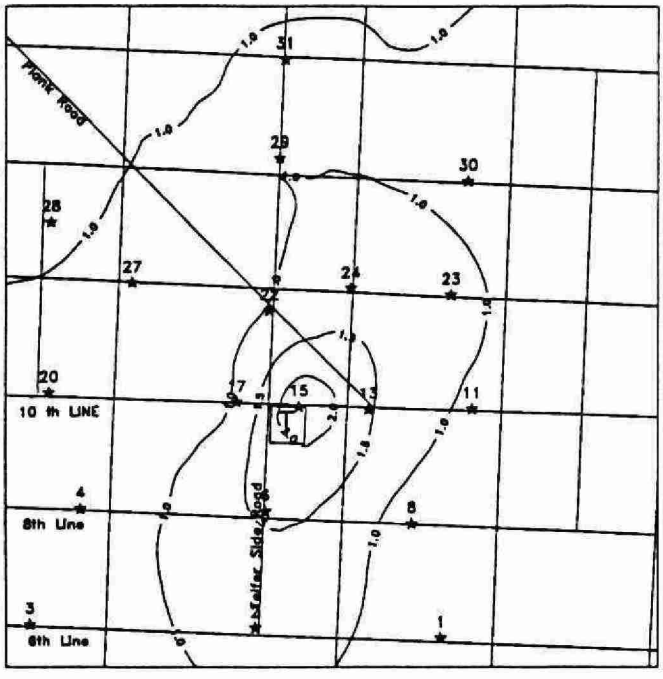
All of the chromium concentrationss were low and there were no exceedences of the Rural ULN for chromium in soil or silver maple foliage. There is no Rural ULN for chromium in moss bags (see Table 10). The chromium levels in surface soil ranged from 20 to 36 µg/g and there was insufficient range to produce a contour map.

All of the silver maple foliage concentrations were either "trace" or "less than". There was a sufficient range in the 1989 results to produce a contour map (see Figure 4.10a). This showed a pattern of marginally elevated-chromium centered on Tricil. As most of the 1990 silver maple results were less than <0.5 µg/g contour maps could not be produced. Silver maple station 15 was the only concentration that was greater than the <0.5 µg/g in 1990. This was also the highest station in 1989.

With the exception of one site, all of the 1989 moss bag results were "trace". In 1990 there were more concentrations above the trace level. This is to be expected as the 1990 moss bags had three times as long to accumulate chromium. There was sufficient range in the data to produce contour maps for both years (see Figure 4.10b and 4.10c). In both years, there was a similar pattern of marginally elevated chromium centered around Tricil. This was also observed in the silver maple results.

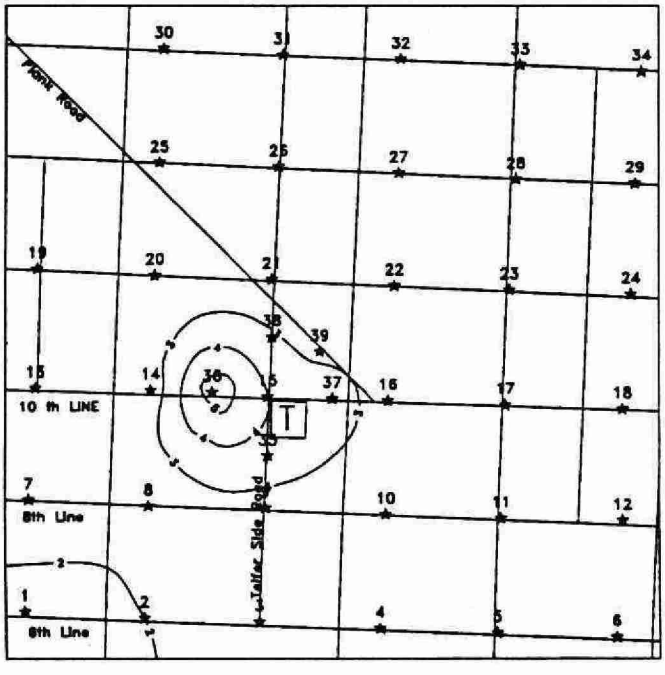
These results indicate that Tricil may be a source of chromium. These emissions are only observable because the natural chromium levels are very low and consistant, thus allowing for the detection of very small accumulations. It should be pointed out that these levels are only marginally above the analytical reporting limits and that none of the results approach the Rural chromium ULN.

Figure 4.10a:
Pattern of Chromium in Silver Maple Foliage in 1989.



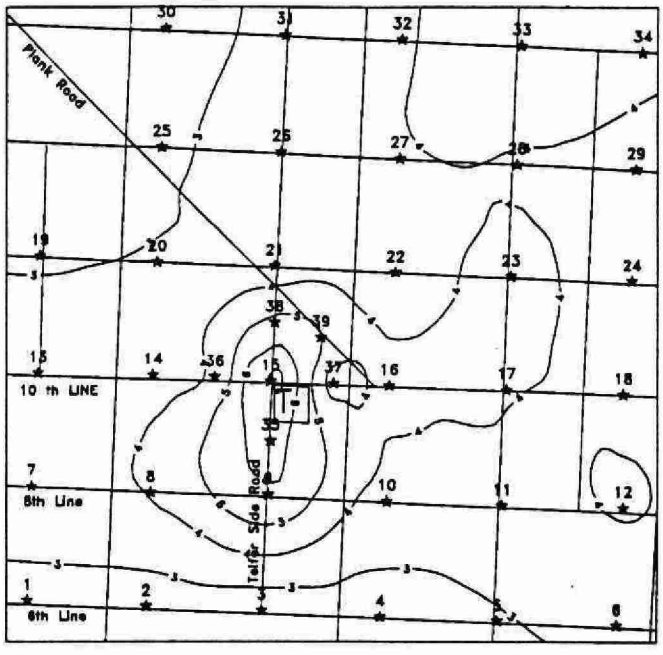
Contour Interval:0.5 Min:1.0 Max:2.5 µg/g

Figure 4.10b:
Pattern of Chromium in Moss Bags in 1989.



Contour Interval:1 Min:2 Max:5 µg/g

Figure 4.10c:
Pattern of Chromium in Moss Bags (3 month exposure) in 1990.



Contour Interval:1 Minimum:3 Maximum:7 µg/g

4.11 Cobalt

The concentrations of cobalt in surface soil, silver maple foliage and moss bags for 1989 and 1990 were very low (see Table 11). None of the results were close to exceeding the Rural cobalt ULN. All but a few of the silver maple results were less than 0.2 µg/g and the majority of the moss bag concentrations were "trace". There was insufficient range in any of the data to produce contour maps and there was no relationship to Tricil.

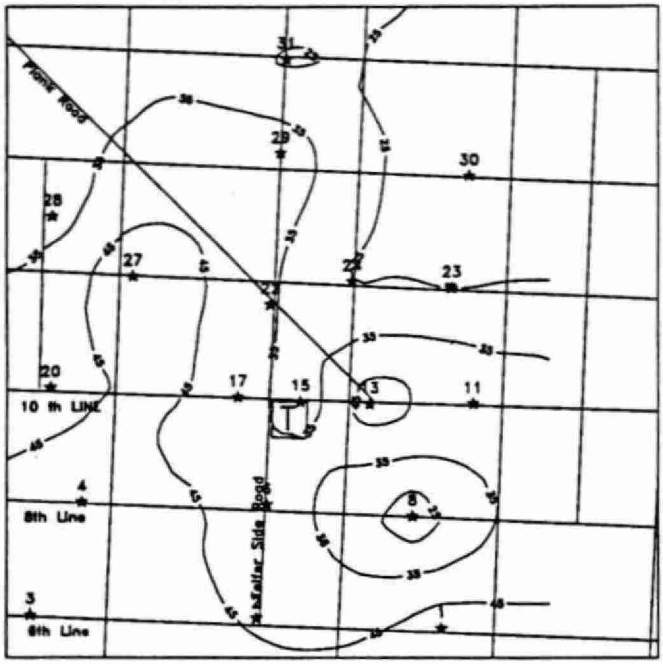
4.12 Copper

All of the copper concentrations in surface soil and silver maple foliage were below the Rural ULN (see Table 12). There was sufficient range in the data to produce contour maps for the surface soil and silver maple in 1989 (see Figure 4.12a and 4.12b). There was no pattern in the copper distribution in soil or silver maple that could be related to Tricil.

There were some exceedences of the Rural ULN for copper in moss bags in 1989 (there are no ULN guidelines for moss bags exposed for three months). These exceedences were marginal in the range of less

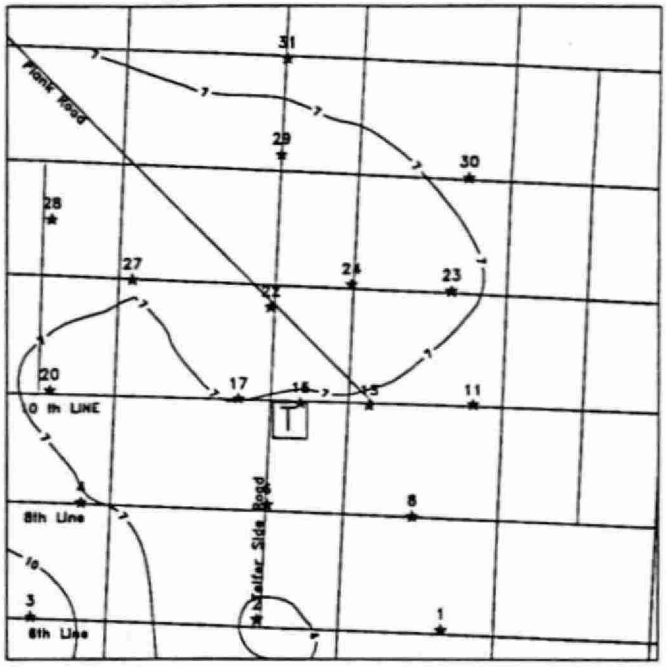
than twice the ULN of 8 µg/g. The only consistent elevated concentrations in 1989 and 1990 were at Stations 26 and 30 (see Figure 4.12c and 4.12d). Even the high value in 1989 was the result of elevated concentrations in only one of the three months. There was no association between moss bag concentrations and Tricil.

Figure 4.12a:
Pattern of Copper in Soil, 0-5 cm, in 1989.



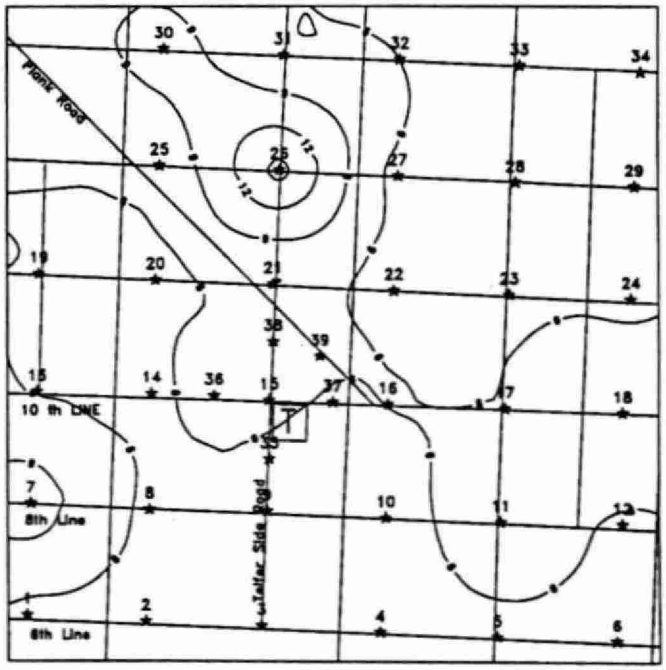
Contour Interval:10 Min:25 Max:45 µg/g

Figure 4.12b:
Pattern of Copper in Silver Maple Foliage in 1990.



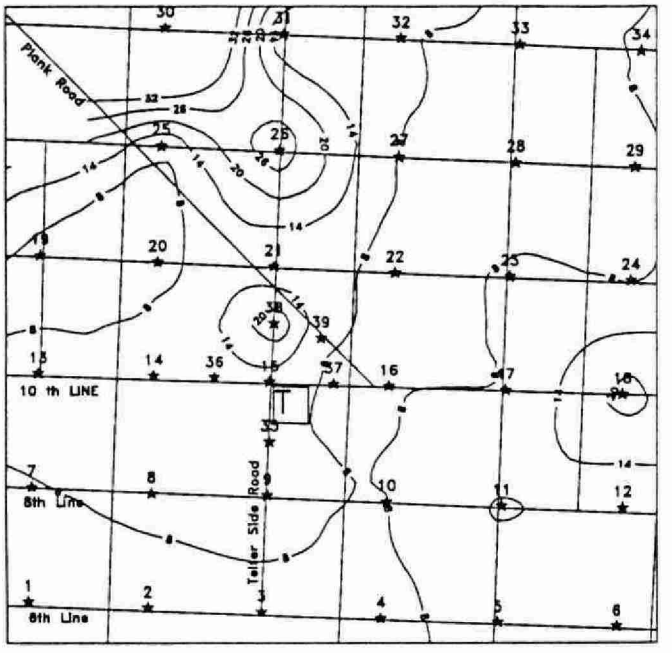
Contour Interval:3 Min:4 Max:12 µg/g

Figure 4.12c:
Pattern of Copper in Moss Bags in 1989.



Contour Interval:3 Min:6 Max:15 µg/g

Figure 4.12d:
Pattern of Copper in Moss Bags (3 month exposure) in 1990.

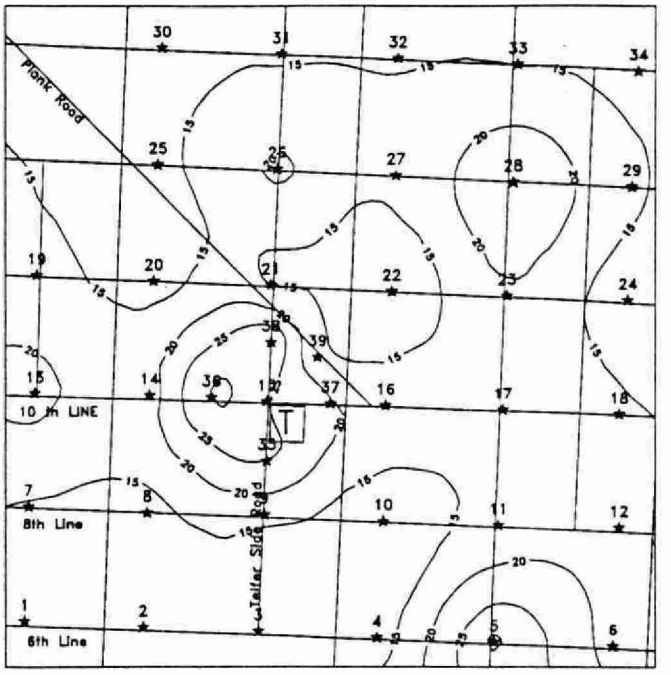


Contour Interval:6 Min:8 Max:32 µg/g

4.13 Floride

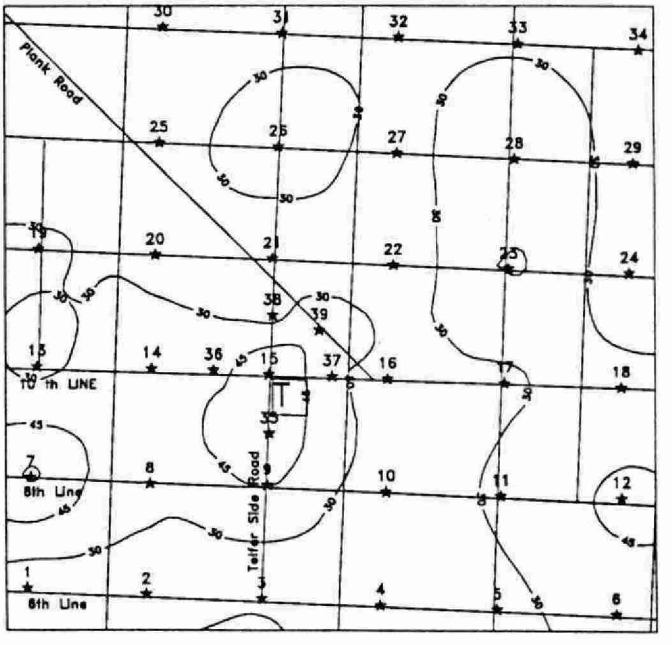
The surface soil samples were not analyzed for fluoride. All of the fluoride in silver maple foliage and moss bags were below the Rural ULN (see Table 13). There was insufficient range in the data for silver maple to produce contour maps. There was sufficient range in the moss bag data to produce contour maps for both years. There was no relationship between the fluoride contour patterns and Tricil in 1989. There was a marginally elevated region around Tricil in 1990, but there were two other unrelated elevated regions of fluoride, to the east and to the west of Tricil (Figure 4.13b). Tricil does not appear to be an environmentally significant source of fluoride emissions.

Figure 4.13a:
Average Pattern of Fluoride in Moss Bags in 1989.



Contour Interval:5 Min:15 Max:30 µg/g

Figure 4.13b:
Pattern of Fluoride in Moss Bags (3 month exposure) in 1990.



Contour Interval:15 Min:15 Max:60 µg/g

4.14 Iron

All of the surface soil, silver maple and moss bag iron concentrations in 1989 and 1990 were well below the Rural ULN guidelines (see Table 14). There was insufficient range to produce any contour maps. Tricil does not appear to be an iron source.

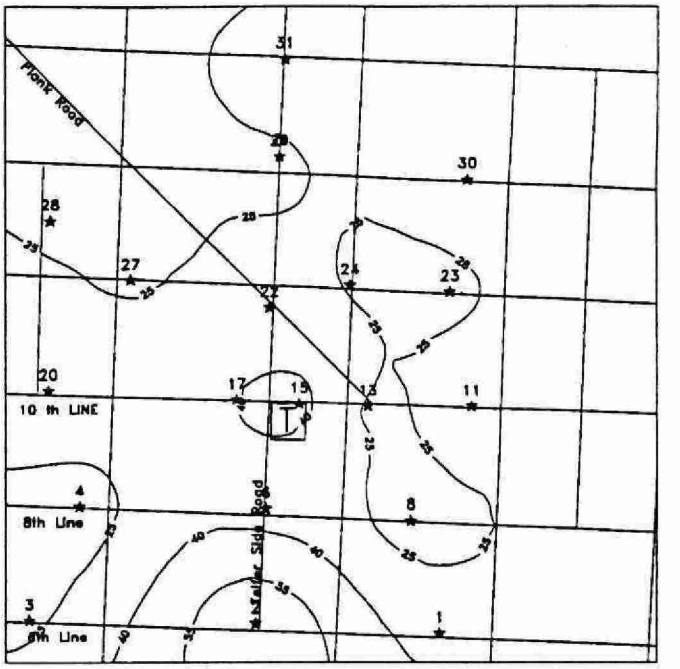
4.15 Lead

All of the surface soil and silver maple foliage lead concentrations for 1989 and 1990 were below the Rural ULN guidelines and all of the concentrations in maple were considered "trace" (see Table 15). There was no pattern to the lead concentrations in soil that could be related to Tricil (see Figure 4.15a). However, there was a pattern of very slightly elevated lead in the silver maple foliage around Tricil in both 1989 and 1990 (see Figure 4.15b and 4.15c). The elevated regions extended from Tricil in the downwind direction, northeast in 1989 and east in 1990.

While there were an number of exceedences of the Rural ULN for lead in moss bags in 1989, these exceedences were only marginal. There was insufficient range in the moss bag data to produce contour maps. The background level of lead in moss bags was too high to show a pattern.

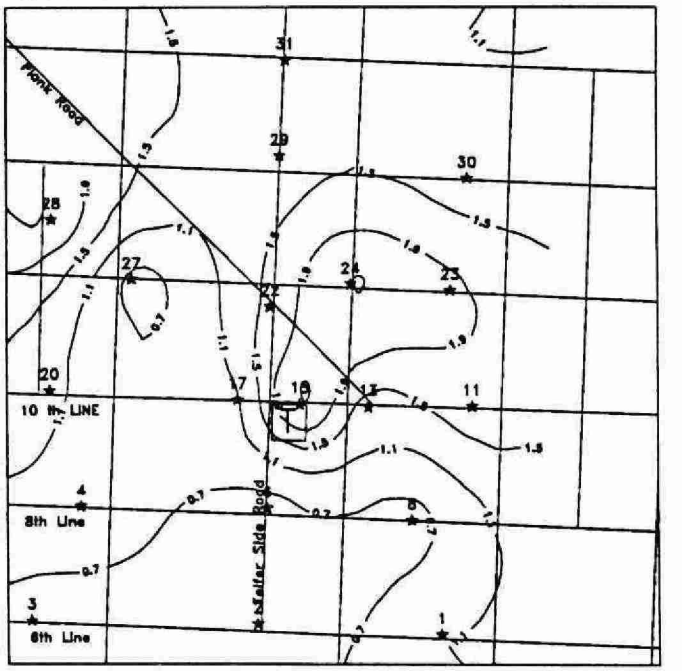
As with chromium, Tricil appears to be a minor source of lead emissions. Like chromium, the marginal evelvations showed up only in the maple results because the natural background level of lead in the maple foliage is very small and consistent. The chromium background levels in soil and moss bags are too high to observe any pattern.

Figure 4.15a:
Pattern of Lead in Soil, 0-5 cm, in 1989.



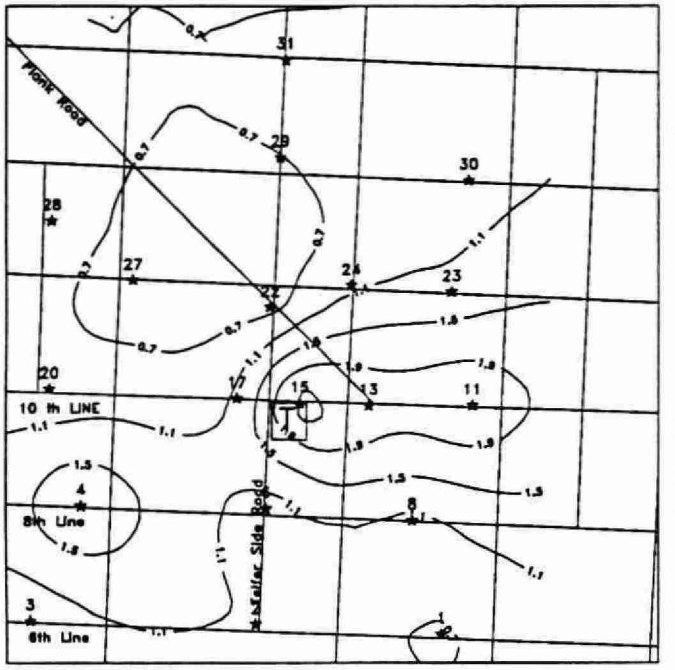
Contour Interval:15 Min:25 Max:55 µg/g

Figure 4.15b:
Pattern of Lead in Silver Maple Foliage in 1989.



Contour Interval:0.4 Min:0.7 Max:2.3 µg/g

Figure 4.15c:
Pattern of Lead in Silver Maple Foliage in 1990.



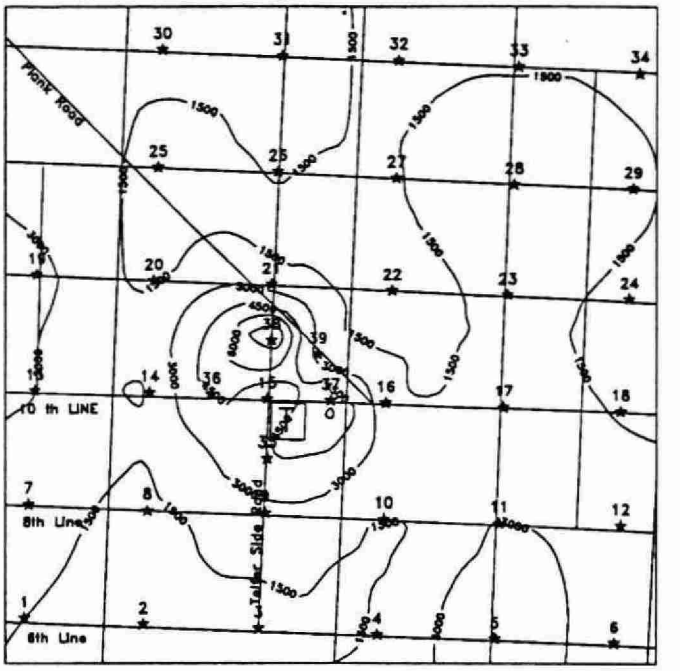
Contour Interval:0.4 Min:0.7 Max:2.3 µg/g

4.16 Magnesium

The surface soil was not analyzed for magnesium (see Table 16). In the silver maple foliage, magnesium levels were well below the Rural ULN and the data range was too narrow to produce contour maps.

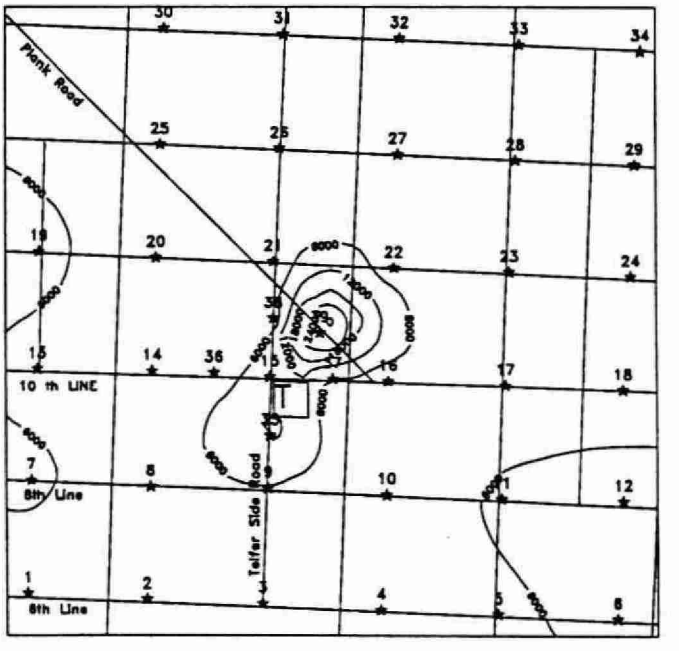
There is no Rural ULN guideline for magnesium in moss bags. There was sufficient range in the 1989 and 1990 moss bag results to produce contour maps (see Figure 4.16a and 4.16b). These show levels of magnesium close to Tricil (within one kilometer) to be substantially higher than the surrounding area. The pattern however is not consistent, as some moss bag stations close to Tricil are quite low. However, the contour maps suggest that there is a pattern of contamination near Tricil.

Figure 4.16a:
Average Pattern of Magnesium in Moss Bags in 1989.



Contour Interval:1500 Min:1500 Max:9000 µg/g

Figure 4.16b:
Pattern of Magnesium in Moss Bags (3 month exposure) in 1990.

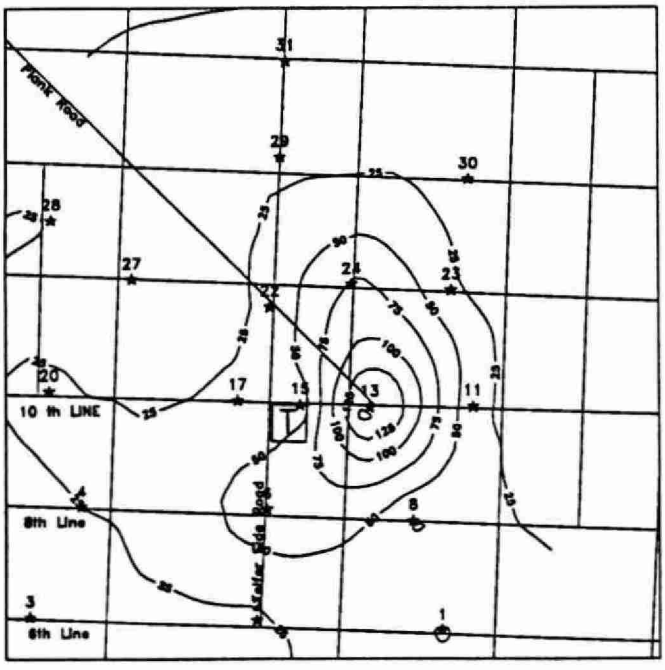


Contour Interval:6000 Min:6000 Max:36000 µg/g

4.17 Manganese

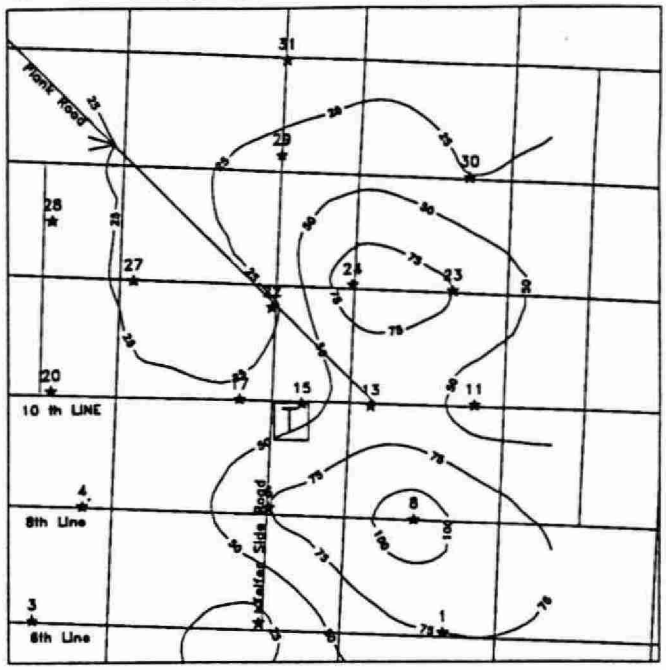
All of the soil manganese concentrations were well below the Rural ULN and there was insufficient range in the data to produce a contour map (see Table 17). There is no Rural ULN guideline for manganese in foliage or moss bags. There was a large enough range in the manganese silver maple foliage concentrations in both 1989 and 1990 to produce contour maps (see Figure 4.17a and 4.17b). These show a pattern of marginally higher foliar manganese concentrations just to the east of Tricil in 1989 and two elevated regions, one to the northeast and one to the southeast, in 1990. There was insufficient range in the 1989 moss bag data to produce a contour map. While there was sufficient range in the 1990 data, there was no pattern that could be associated with Tricil (Figure 4.17c). As with some other elements, if the elevated levels observed in the silver maple were due to Tricil the moss bag data may not be sueful in coroborating the pattern of contamination because the background level for manganese in the moss bags was about four times as high as for the silver maple.

Figure 4.17a:
Pattern of Manganese in Silver Maple Foliage in 1989.



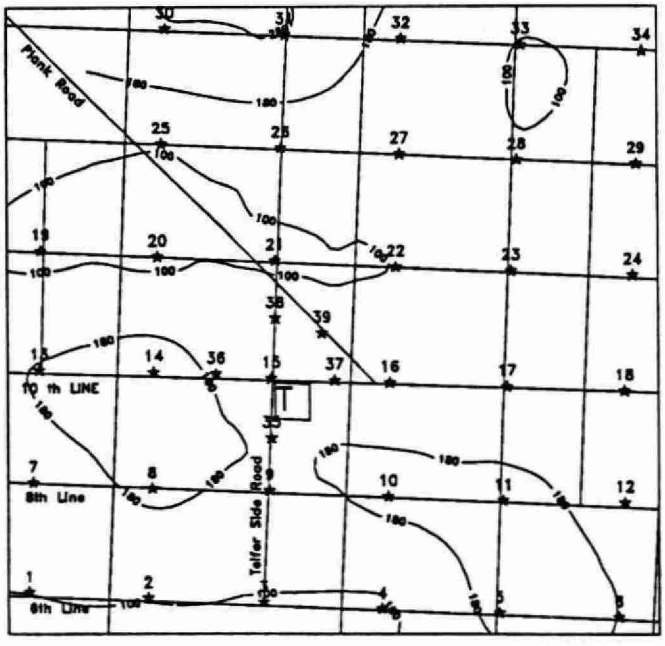
Contour Interval:25 Min:25 Max:175 µg/g

Figure 4.17b:
Pattern of Manganese in Silver Maple Foliage in 1990.



Contour Interval:25 Min:25 Max:175 µg/g

Figure 4.17c:
Pattern of Manganese in Moss Bags (3 month exposure) in 1990.

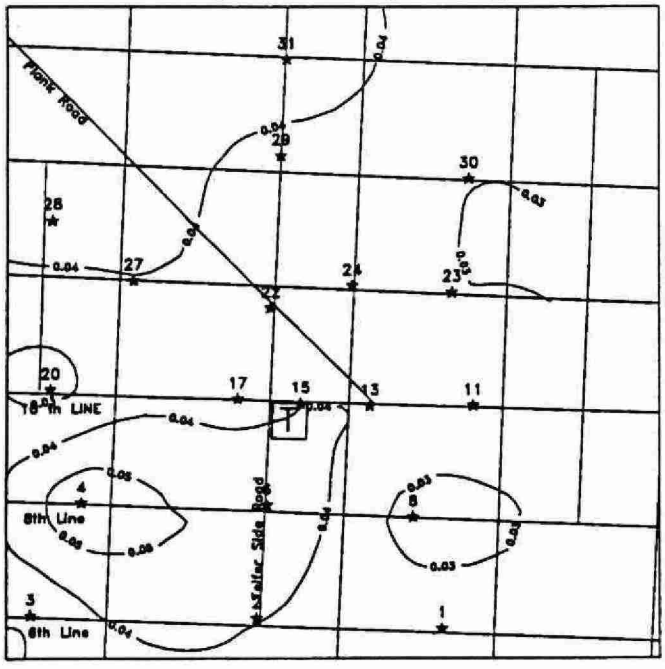


Contour Interval:80 Min:100 Max:260 µg/g

4.18 Mercury

The surface soil samples were not analyzed for mercury. All of the silver maple foliage mercury concentrations were below the Rural ULN guideline, and all values were either "trace" or less than 0.01 µg/g (see Table 18). There was sufficient range in the silver maple foliage data to produce contour maps for both 1989 and 1990 (see Figure 4.18a and 4.18b). There was no pattern of elevated mercury in maple foliage in the 1989 results that could be associated with Tricil. The 1990 results showed a distinct pattern of slightly elevated mercury concentrations centered on Tricil. The moss bag results were also all below the Rural ULN for mercury, and there was insufficient range in the data to produce contour maps.

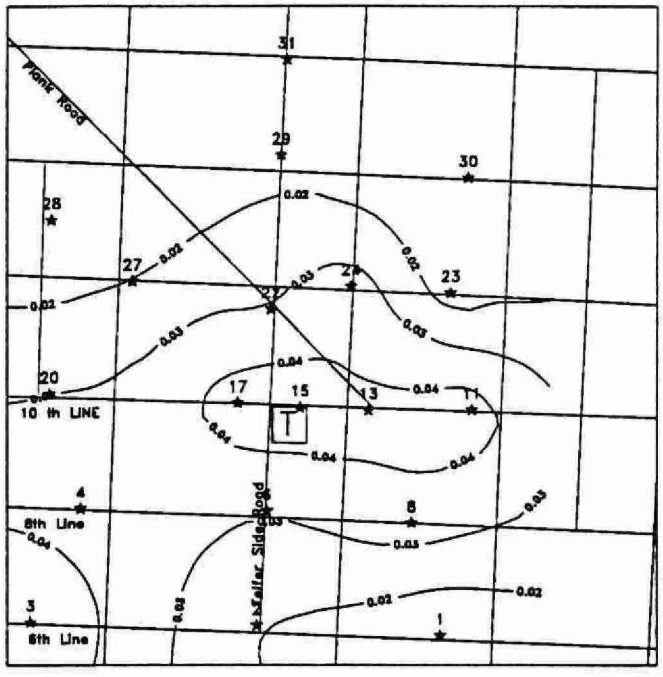
Figure 4.18a:
Pattern of Mercury in Silver Maple Foliage in 1989.



Contour Interval:0.01 Min:0.02 Max:0.06 µg/g

As with lead the background concentrations of mercury in moss bags were significantly higher than the background silver maple concentrations. The small increase in the mercury observed in silver maple foliage around Tricil in 1990 would not be observable in the moss bags. It should also be pointed out that the elevated concentrations observed in the silver maple in 1990 were actually very low (considered "trace") and just above the reporting limit of 0.01 µg/g.

Figure 4.18b:
Pattern of Mercury in Silver Maple Foliage in 1990.

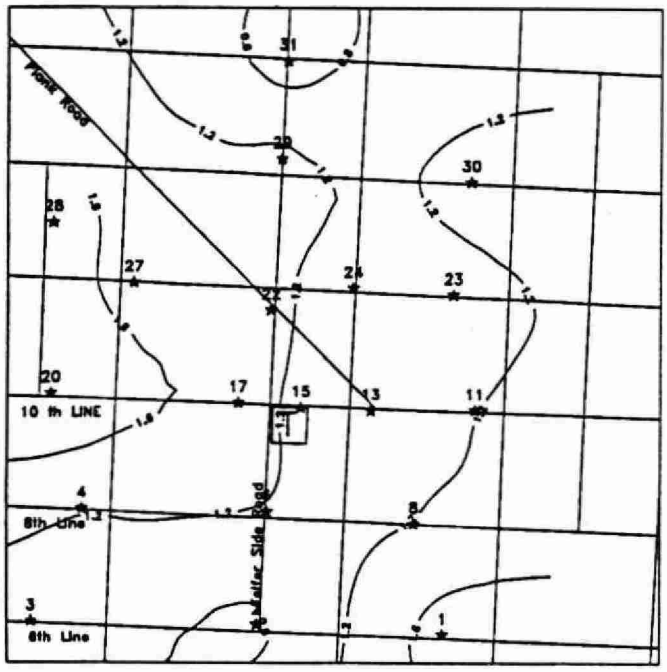


Contour Interval:0.01 Min:0.02 Max:0.06 µg/g

4.19 Molybdenum

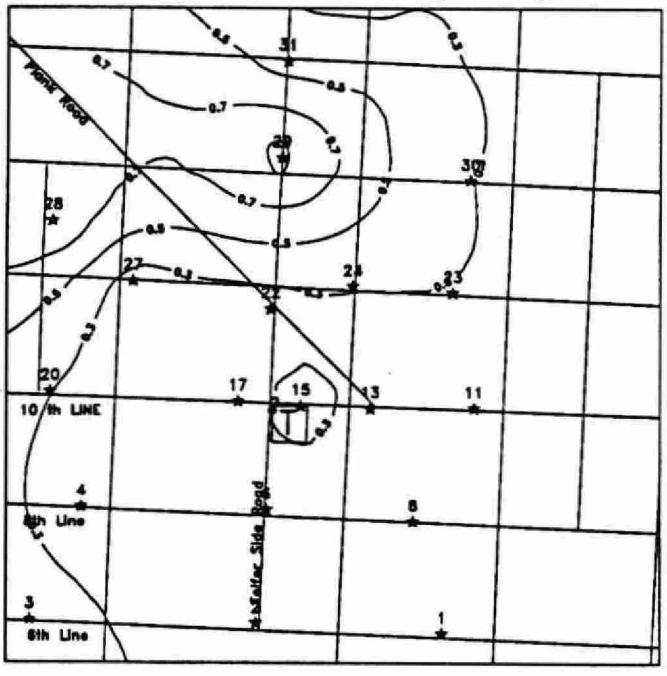
All of the soil, silver maple foliage and moss bag molybdenum concentrations for both 1989 and 1990 were low (see Table 19). There were no exceedences of the Rural ULN guidelines for molybdenum in soil or foliage. There is no Rural molybdenum ULN for moss bags. None of the contour maps showed any pattern of elevated molybdenum concentrations that could be associated with Tricil (see Figures 4.19a to 4.19d).

Figure 4.19a:
Pattern of Molybdenum in Soil, 0-5 cm, in 1989.



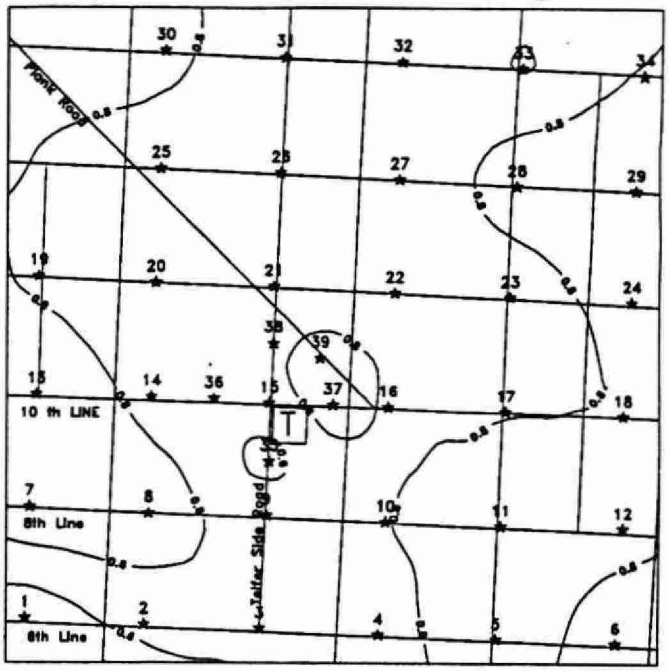
Contour Interval:0.4 Min:0.8 Max:2.0 µg/g

Figure 4.19b:
Pattern of Molybdenum in Silver Maple Foliage in 1989.



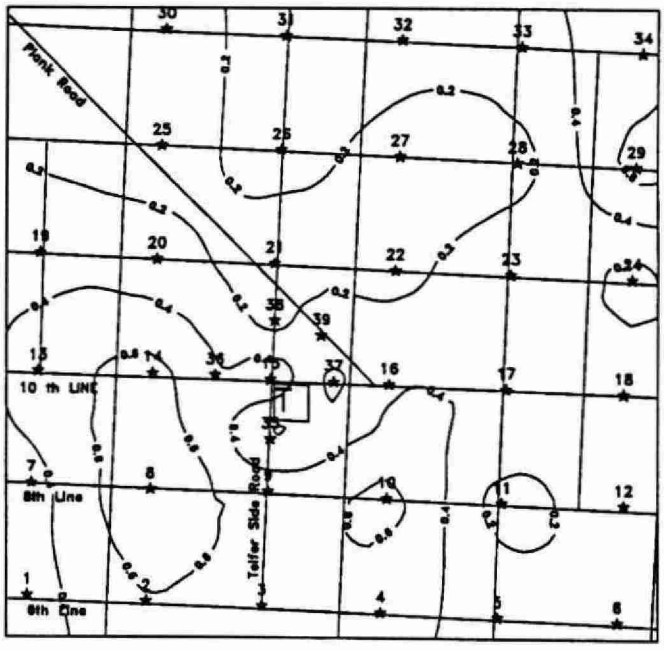
Contour Interval:0.2 Min:0.3 Max:0.9 µg/g

Figure 4.19c:
Average Pattern of Molybdenum in Moss Bags in 1989.



Contour Interval:0.2 Min:0.2 Max:0.8 µg/g

Figure 4.1d:
Pattern of Molybdenum in Moss Bags (3 month exposure) in 1990.

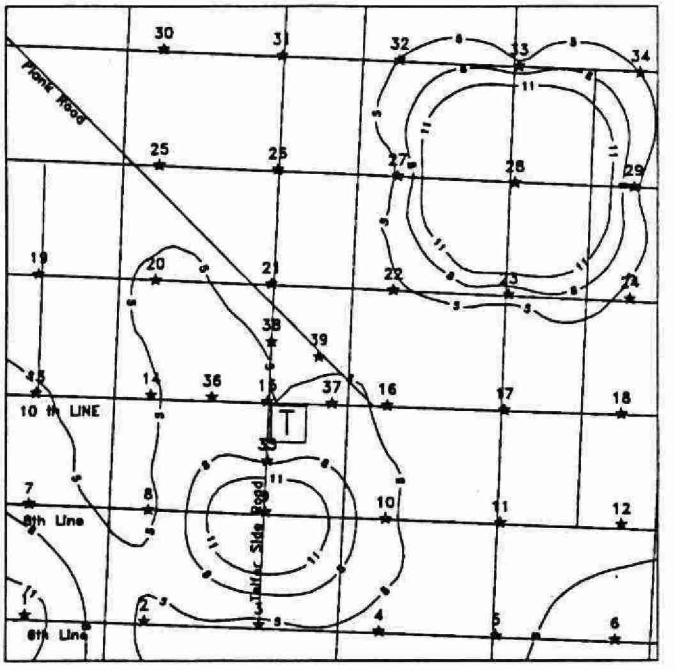


Contour Interval:0.2 Min:0.2 Max:0.8 µg/g

4.20 Nickel

All of the surface soil and silver maple foliage nickel concentrations were well bellow the Rural ULN guidelines (see Table 20). There was insufficient range in the soil and maple data to produce contour maps. There were a number of exceedences of the Rural ULN for moss bags of 6 µg/g. The nickel moss bag concentrations were substantially higher in July 1989. Reguardless of these spuriously high data, there was no pattern of contamination relative to Tricil (Figure 4.20).

Figure 4.20:
Average Pattern of Nickel in Moss Bags in 1989.



Contour Interval:3 Min:5 Max:11 µg/g

4.21 Nitrogen

Only silver maple foliage for 1989 and 1990 and the 1990 moss bags were analyzed for nitrogen (see Table 21). There are no Rural ULN guidelines for nitrogen in foliage or moss bags. All nitrogen concentrations were bellow 30 mg/g for both maple and moss bags and there was insufficient range in the data to produce contour maps. Tricil is not a source of nitrogen.

4.22 Phosphorus

Only silver maple foliage for 1989 and 1990 was analyzed for phosphorus (see Table 22). There is no Rural ULN guideline for phosphorus in foliage. All phosphorus concentrations were below 4 mg/g and there was insufficient range in the data to produce contour maps. Tricil is not a source of phosphorus.

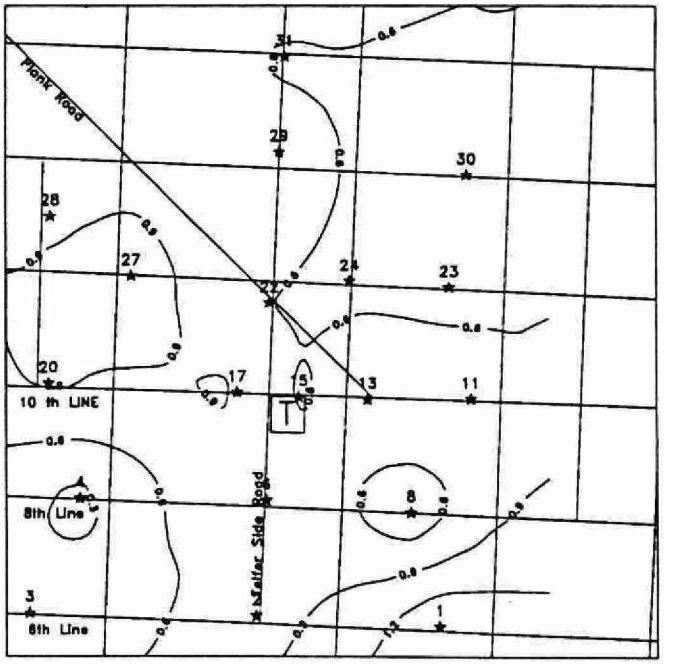
4.23 Potassium

Potassium was only analyzed for in the silver maple for 1989 and 1990 (see Table 23). There is no Rural ULN guideline for potassium in foliage. There was insufficient range in the results to produce contour maps. Tricil does not appear to be source of potassium.

4.24 Selenium

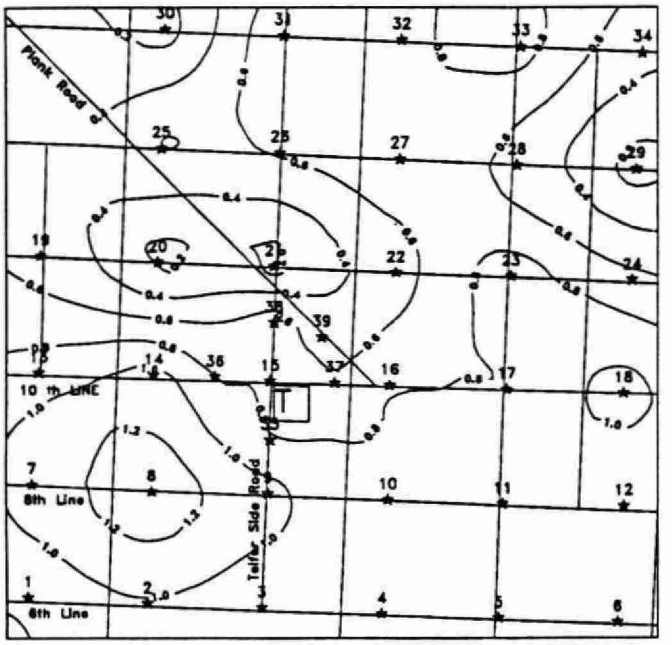
All of the selenium results for surface soil, silver maple foliage and moss bags were quite low, trace or less than 0.2 µg/g (see Table 24). None of the soil or maple results exceeded the Rural ULNs. There were a number of marginal exceedences of the Rural ULN for selenium in moss bags. Only the soil and 1990 moss bag results had enough range to produce contour maps (Figures 4.24a and 4.24b). There was no pattern of elevated selenium around Tricil. The elevated areas were scattered throughout the area that was sampled.

Figure 4.24a:
Pattern of Selenium in Soil, 0-5 cm, in 1989.



Contour Interval:0.3 Min:0.3 Max:1.5 µg/g

Figure 4.24b:
Pattern of Selenium in Moss Bags (3 month exposure) in 1990.



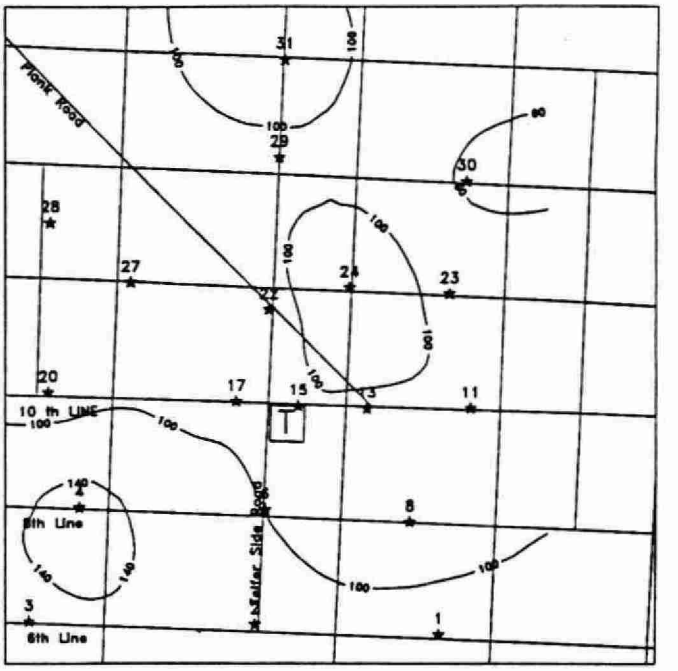
Contour Interval:0.2 Min:0.2 Max:1.4 µg/g

4.25 Sodium

Like chloride, there was considerable range in the soil, silver maple and moss bag sodium concentrations (see Table 25). Levels of sodium in silver maple foliage were not as high as chloride, but this was expected as most plants accumulate chloride from the soil disproportionately to the rate at which sodium is taken up. There was one exceedence of the ULN for sodium in silver maple foliage in 1989 (112 ppm at Site 8). This one site was 5 to 10 times higher than almost all of the other sites that year. However, this anomolous concentration was not repeated in 1990, nor was it coroborated by the moss bag data in either 1989 or 1990. The rest of the silver maple results were well below the Rural ULN guideline of 50 µg/g. There is no Rural ULN guidelines for sodium in soil of moss bags.

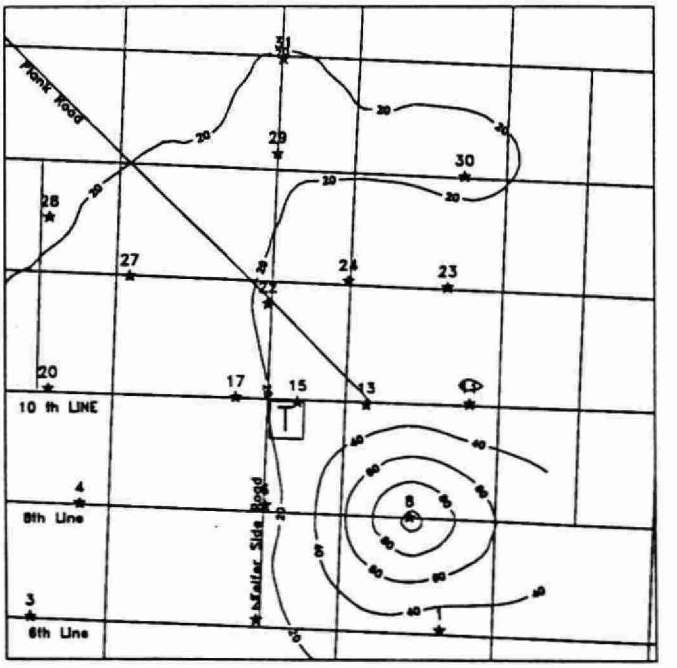
While there was sufficient range in the sodium data to produce contour maps for soil (Figure 4.25a), maple (Figures 4.25b & c) and moss bags (Figures 4.25d & e) for both 1989 and 1990, there was no consistent pattern of elevated sodium associated with Tricil. The 1989 maple foliage map is misleading because the contour gradient to the southeast of Tricil is driven entirely by the one site with the anomalously high sodium concentration. There was an elevated region of sodium around Tricil in the 1989 moss bag map, however there also were three other elevated regions at a considerable distance from Tricil.

Figure 4.25a:
Pattern of Sodium in Soil, 0-5 cm, in 1989.



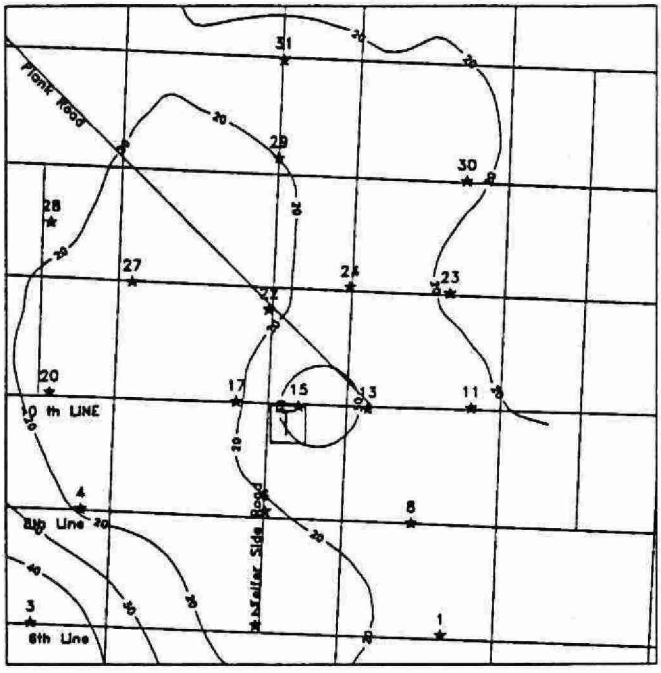
Contour Interval:40 Min:60 Max:140 µg/g

Figure 4.25b:
Pattern of Sodium in Silver Maple Foliage in 1989.



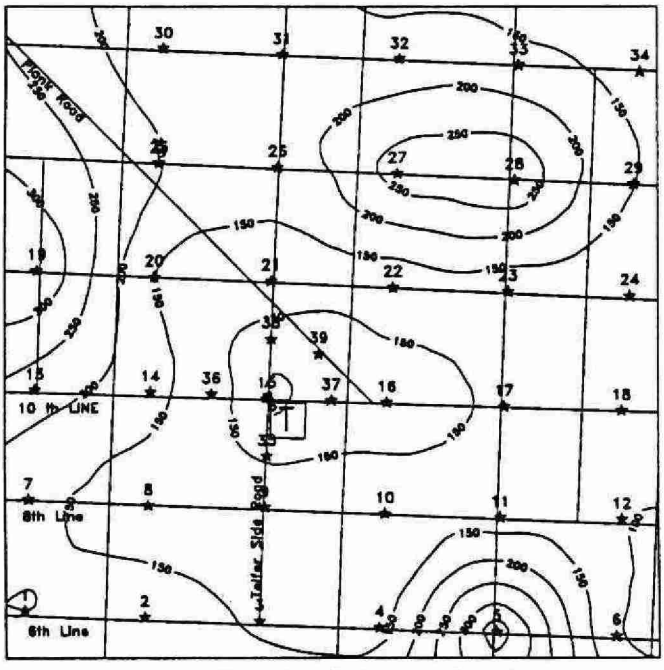
Contour Interval:20 Min:20 Max:100 µg/g

Figure 4.25c:
Pattern of Sodium in Silver Maple Foliage in 1990.



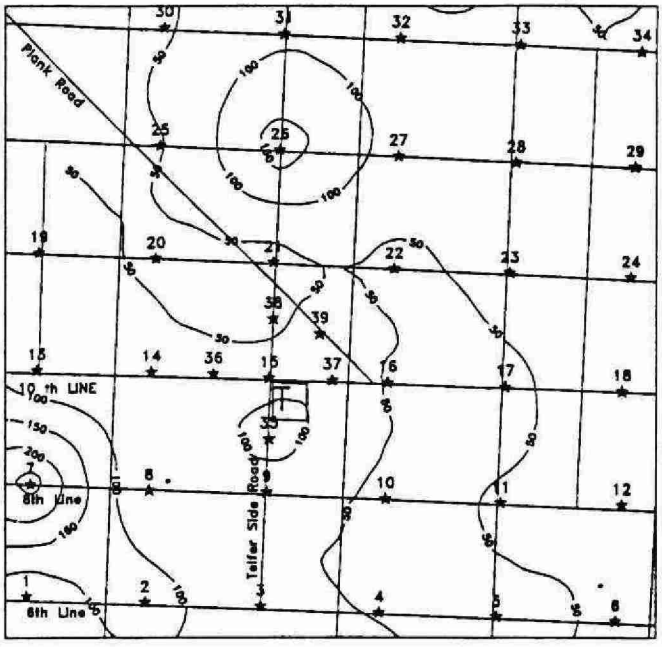
Contour Interval:10 Min:20 Max:40 µg/g

Figure 4.25d:
Average Pattern of Sodium in Moss Bags in 1989.



Contour Interval:50 Min:50 Max:350 µg/g

Figure 4.25e:
Pattern of Sodium in Moss Bags (3 month exposure) in 1990.

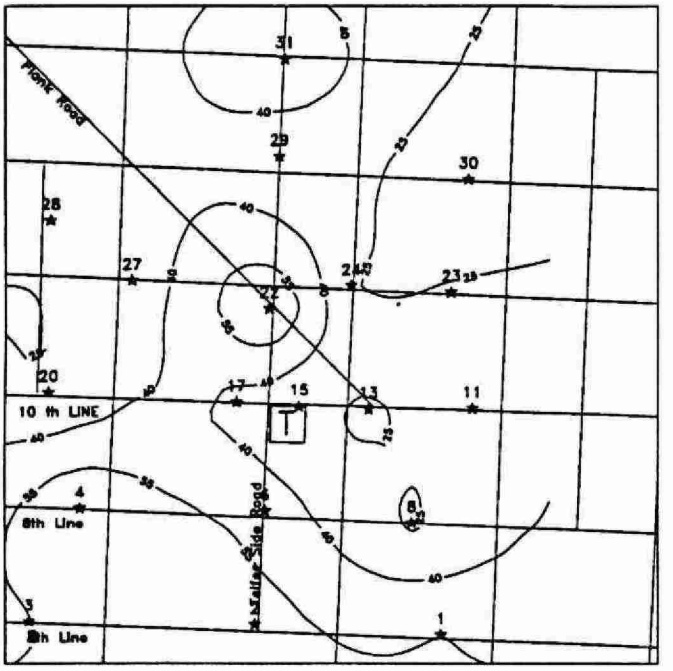


Contour Interval:50 Min:50 Max:250 µg/g

4.26 Strontium

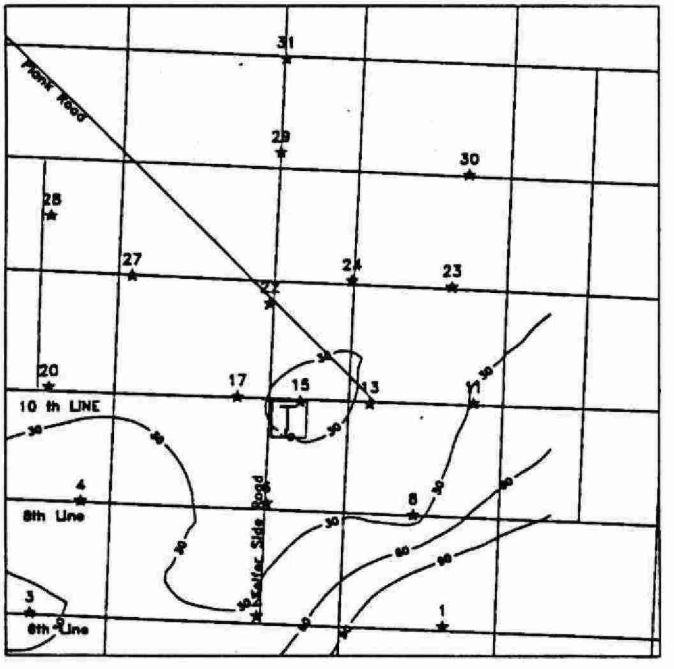
There are no ULN guidelines for strontium in surface soil, foliage or moss bags. Most of the soil concentrations were below 50 µg/g (see Table 26), whereas most of the foliar strontium concentrations were less than 40 µg/g. The few sites that were higher were scattered throughout the sample area. The moss bag results were generally below 30 µg/g, and there was little difference between the one month exposures in 1989 and the three month exposures in 1990. This similarity between the one and three month exposures suggest that this concentration range is the background for moss bags, and there was little strontium in the air. All but the moss bag results had sufficient data range to produce contour maps. There was no pattern of elevated strontium in soil (Figure 4.26a), or maple (Figures 4.26b & c) that could be related to Tricil.

Figure 4.26a:
Pattern of Strontium in Soil, 0-5 cm, in 1989.



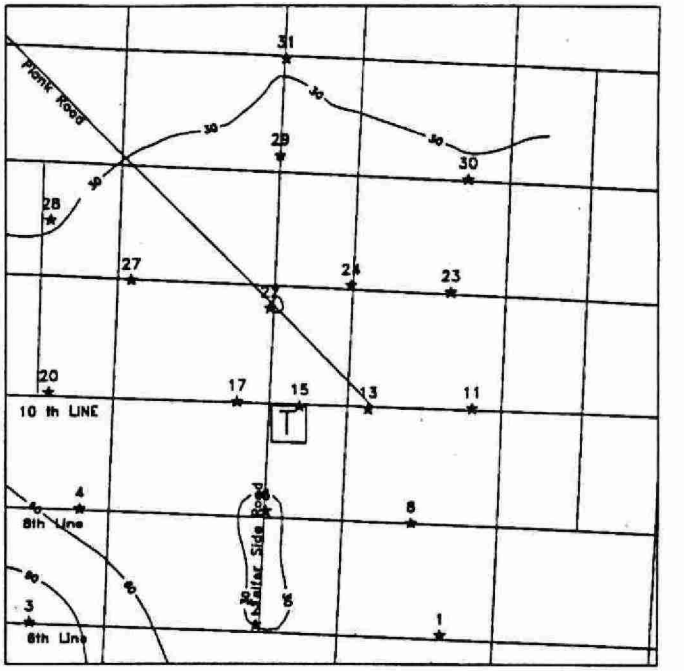
Contour Interval:15 Min:25 Max:55 µg/g

Figure 4.26b:
Pattern of Strontium in Silver Maple Foliage in 1989.



Contour Interval:30 Minimum:30 Maximum:90 µg/g

Figure 4.26c:
Pattern of Strontium in Silver Maple Foliage in 1990.



Contour Interval:30 Min:30 Max:180 µg/g

4.27 Sulphur

Only silver maple for 1989 and 1990 and the 1990 moss bags were analyzed for sulphur. All of the silver maple concentrations were well below the Rural ULN guideline for sulphur in foliage. There is no Rural ULN guideline for sulphur in moss bags (see Table 27). The moss and foliar sulphur concentrations were not high (all bellow 0.34 %). There was insufficient range in the data to produce contour maps. Tricil is not a source of sulphur.

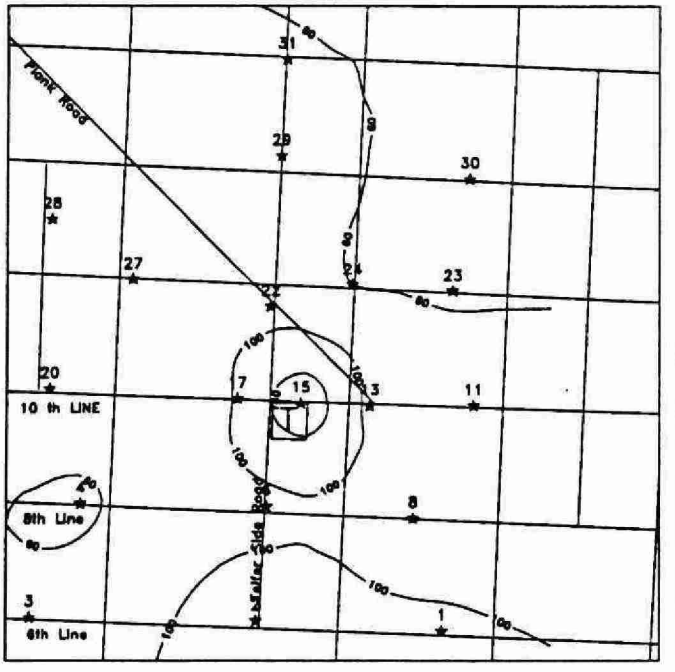
4.28 Vanadium

There were no ULN exceedences for vanadium in soil, maple foliage, or moss bags in either 1989 or 1990 (see Table 28). All soil, maple and moss bag concentrations were low (the maple concentrations were either "trace" or less than 0.5 µg/g). There was insufficient data range to produce contour maps. Tricil is not a source of vanadium.

4.29 Zinc

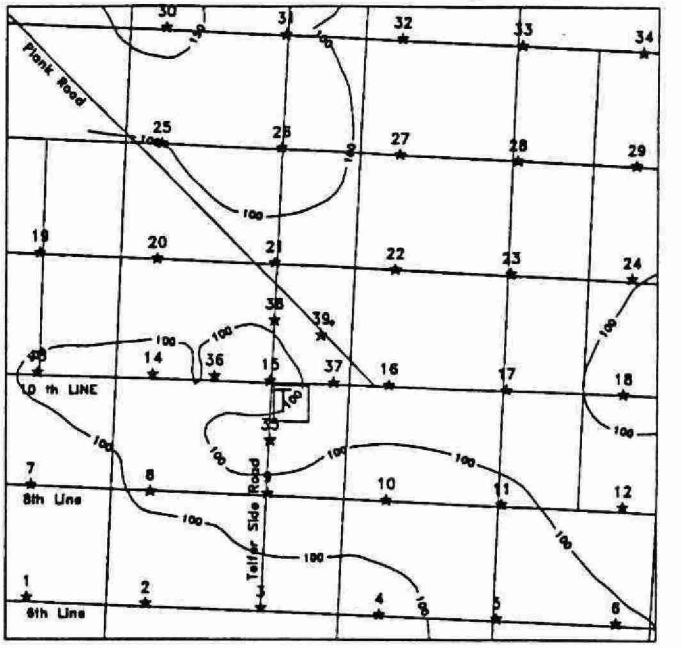
With the exception of three moss bag sites from July, 1989 all of the concentrations were well below the Rural ULN guidelines for zinc in soil, foliage and moss bags (see Table 29). The three moss bag sites that exceeded the ULN were only marginally elevated. These isolated zinc elevations in moss were not associated with Tricil. There was only a sufficient data range to produce contour maps for soil and the 1990 moss bags. There was a slightly elevated zinc concentration in soil at Station 15 on the northern boundary of the Tricil property. However, similarly elevated soil zinc concentrations also occured well to the south of Tricil. There was no consistant pattern of zinc in soil, or moss bags in relation to Tricil.

Figure 4.29a:
Pattern of Zinc in Soil, 0-5 cm, in 1989.



Contour Interval:40 Min:60 Max:140 µg/g

Figure 4.29b:
Pattern of Zinc in Moss Bags (3 month exposure) in 1990.



Contour Interval:50 Min:50 Max:150 µg/g

Section 5: Summary

There was no evidence that the 17 inorganic elements for which the soil had been analyzed had significantly accumulated in surface soil withing 5 km of the Tricil operation. If there are emissions of these elements from Tricil, they cannot be consistantly distinguished from natural background concentrations in the soil at this time.

For 21 of the 29 inorganic parameters in silver maple foliage, there was either insufficient range between the minimum and maximum concentrations to generate a contour map or, where there was sufficient range, there was no pattern of accumulation associated with the Tricil operation. The test parameters with elevated concentrations associated with Tricil could be separated into two types. The first type were those with a pattern of higher concentrations around Tricil but the pattern was not strong. These included aluminum, barium, calcium, cadmium, and manganese. The second group had very low consistent background levels with a marginal but distinct concentration gradient associated with the Tricil location. These included chromium, lead and mercury (mercury only in 1990). Even though these elements were elevated, none exceeded their corresponding Rural ULN guidelines.

As with the 1987 survey, there were a large number of elevated chloride concentrations found in silver maple foliage in 1989 and 1990. Even with the expanded sampling network in 1989 and 1990 and the Surfer-generated contour maps there was still no apparent relationship bewteen environmental chloride concentrations and Tricil. These elevated chloride concentrations are probably due to the localized deposits of salt (salt domes) in Lambton county.

For 23 of the 27 inorganic parameters in moss bags, there was either insufficient range between the minimum and maximum concentrations to generate a contour map or, where there was sufficient range, there was no pattern of accumulation associated with the Tricil operation. Calcium in moss bags for 1989 and 1990 was elevated in a similar manner as the calcium in silver maple foliage. There was a weak association with the Tricil operation for this element. The chromium levels in moss bags for both years corroborated the silver maple results. There was a consistant concentration gradient for chromium around Tricil. The elevated levels of aluminum, barium, lead, manganese and mercury that occurred in the silver maple foliage were not observed in the moss bags due to the significantly higher natural background level of these elements in the moss. Magnesium also had a strong but inconsistent pattern within about one kilometer of the Tricil operation in both 1989 and 1990.

It is not possible to determine if the incinerator or the land fill operation was the source of the elevated concentrations. However, the aluminum, calcium and manganese elevations could be related to dust created by the landfill operation. These are common components of the clay soil found in the area.

These surveys concluded that Tricil is not a significant source of inorganic emissions to the atmosphere, and that inorganic contamination has not accumulated in the surface soil. However, based on the analysis of soil, tree foliage, and moss bags and the computer-generated contour maps, Tricil, either through process emissions from the incinerator or fugitive emissions from the landfill, may be a marginal source of aluminum, barium, cadmium, calcium, chromium, lead, manganese, and mercury. In all cases, these concentrations were only marginally elevated above local background and did not exceed rural ULN guidelines for soil and tree foliage. Therefore, at this time, the degree of contamination was considered to be environmentally inconsequential and would not interfere with the normal use of the land.

In light of the data obtained over a period of 14 years, and the limited potential for contamination documented to date, it is recommended that the survey frequency should be reduced to about once every three to five years. This could be modified to more frequent visits if spills occur or if process changes are implemented.

Appendix A: Summary of Survey Activities

Year	Silver Maple	Grass	Soil	Moss Bags	Stations Sampled
1977	X		X		30
1978	X	X	X		30
1979	X	X			30
1981	X	X			30
1982	X	X			9
1983	X				8
1984	X				12
1985	X				12
1986	X				12
1987	X				12
1989	X		X	X	20[a] + 39[b]
1990	X			X	20[a] + 39[b]

[a] - silver maple and soil stations.
[b] - moss bag stations.

Appendix B: References

(1) Ontario Ministry of the Environment, Air Resources Branch. 1983. Field Investigation Manual. Phytotoxicology Section - Air Resources Branch; Technical Support Sections - NE and NW Regions

(2) Ontario Ministry of the Environment, Air Resources Branch. 1989. Ontario Ministry of the Environment "Upper Limit of Normal" Contaminant Guidelines for Phytotoxicology Samples. Phytotoxicology Section - Air Resources Branch ARB-138-88-Phyto. ISBN: 0-7729-5143-8

(3) Ontario Ministry of the Environment, Air Resources Branch. 1977. A report of a Phytotoxicology Secion survey in the vicinity of Tricil Limited, Corunna on August 3-5, 1977.

(4) Ontario Ministry of the Environment, Air Resources Branch. 1978. A report of a Phytotoxicology Secion survey in the vicinity of Tricil Limited, Corunna on August 2-3, 1978.

(5) Ontario Ministry of the Environment, Air Resources Branch. 1981. A report of a Phytotoxicology Secion survey in the vicinity of Tricil Limited, Corunna on July 30-31, 1979.

(6) Ontario Ministry of the Environment, Air Resources Branch. 1982. Phytotoxicology Assessment survey in the vicinity of Tricil Ltd., Corunna 1981 and 1982. ARB-PH-02-82-48.

(7) Ontario Ministry of the Environment, Air Resources Branch. 1984. Phytotoxicology Assessment survey in the vicinity of Tricil Ltd., Corunna 1983. ARB-105-84-PHYTO.

(8) Ontario Ministry of the Environment, Air Resources Branch. 1985. A report on the Phytotoxicology investigation of damage to vegetation in Lot 9, Concession 9, Moore Township, Ontarion on August 21, 1985. ARB-163-85-PHYTO.

(9) Ontario Ministry of the Environment, Air Resources Branch. 1985. Phytotoxicology Assessment survey in the vicinity of Tricil Ltd., Corunna 1984. ARB-062-85-PHYTO.

(10) Ontario Ministry of the Environment, Air Resources Branch. 1986. Phytotoxicology Assessment survey in the vicinity of Tricil Ltd., Corunna 1984. ARB-233-85-PHYTO.

(11) Ontario Ministry of the Environment, Air Resources Branch. 1987. Phytotoxicology Assessment Survey Investigation in the Vicinity of Tricil Ltd., Corunna 1986. ARB-105-87-PHYTO.

(12) Ontario Ministry of the Environment, Air Resources Branch. 1988. Phytotoxicology Assessment Survey Investigation in the Vicinity of Tricil Ltd., Corunna 1987. ARB-086-88-PHYTO.

Appendix C: Derivation and Significance of MOE "Upper Limits of Normal" Contaminant Guidelines

The MOE "upper limits of normal" contaminant guidelines essentially represent the expected maximum concentration of contaminants in surface soil (non-agricultural), foliage (tree and shrub), grass, moss bags and or snow from areas of Ontario not subject to the influence of point sources of emissions. "Urban" guidelines are based upon samples collected from centers of minimum 10,000 population. "Rural" guidelines are based upon samples collected from non-built-up areas. Samples were collected by MOE personnel using standard sampling techniques (ref: Ministry of the Environment, 1983. Field Investigation Manual. Phytotoxicology Section - Air Resources Branch: Technical Support Sections - NE and NW Regions). Chemical analyses were performed by the MOE Laboratory Services Branch.

The guidelines were calculated by taking the arithmetic mean of available analytical data and adding three standard deviations of the mean. For those distributions that are "normal", 99% of all contaminant levels in samples from "background" locations (i.e. not affected by point sources nor agricultural activities) will lie below these upper limits of normal. For those distributions that are non-normal, the calculated upper limits of normal will not actually equal the 99th percentile, but nevertheless they lie within the observed upper range of MOE results for Ontario samples.

Due to the large variability in element concentrations which may be present across Ontario, even in background data, control samples should always be collected. This is particularly important for soils, which may show large regional variations in element composition due to difference in parent material. Species of vegetation which naturally accumulate high levels of an element also may be encountered.

It is stressed that these guidelines do not represent maximum desirable or allowable levels of contaminants. Rather, they serve as levels which, if exceeded, would prompt further investigation on a case by case basis to determine the significance, if any, of the above normal concentration(s). Concentrations which exceed the guidelines are not necessarily toxic to plants, animals or man. Concentrations which are below the guidelines are not known to be toxic.

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